WIRE AND WIRE PRODUCTS

SEPTEMBER 1948

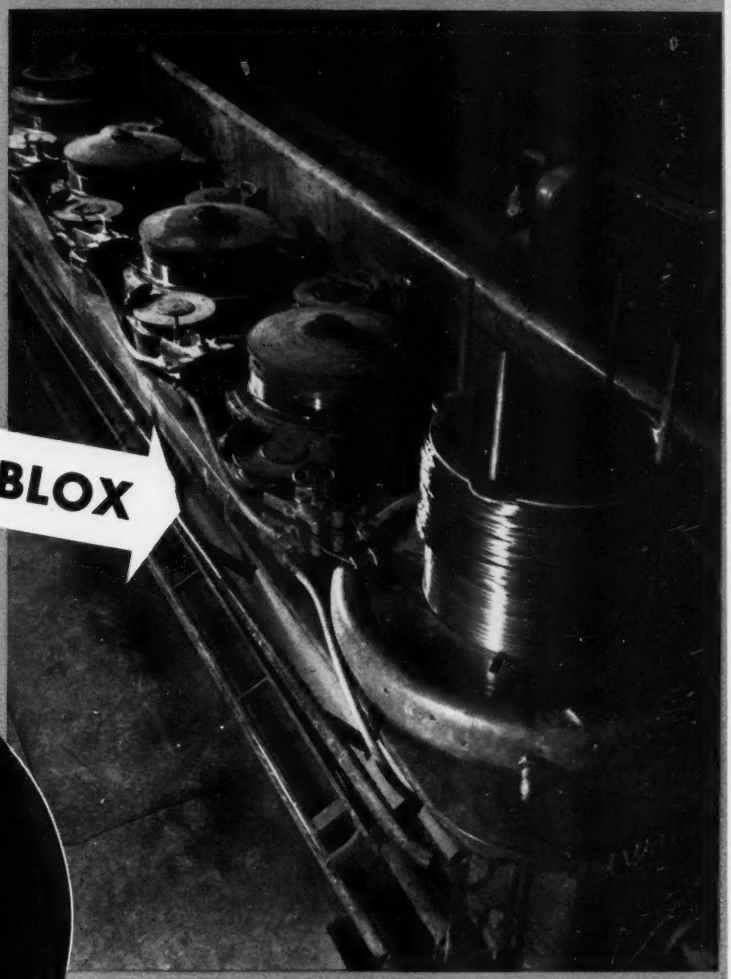
in Today's Wire Drawing

Take it Fast and Steady with Vaughn

MOTOBLOX

and

MOTOBLOC



"Quick on the Draw!"

VAUGHN MACHINERY

PROFITABLY USED BY LEADING WIRE MILLS SINCE 1871

These two famous Vaughn Wire Drawing Machine types meet every production demand of the modern wire manufacturer. Let us detail sizes and capacities for your applications!

THE VAUGHN MACHINERY COMPANY

CUYAHOGA FALLS, OHIO, U. S. A.

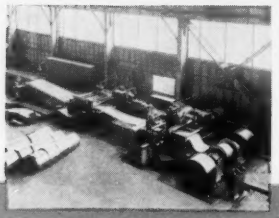
COMPLETE COLD DRAWING EQUIPMENT—Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

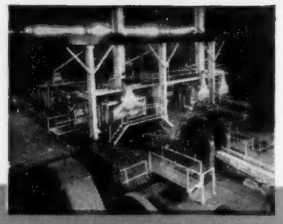
WEAN ENGINEERING Company, Inc.

WARREN, OHIO

SPECIALISTS IN SHEET TIN AND STRIP MILL EQUIPMENT

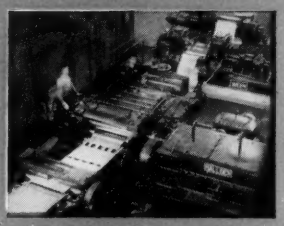


Side Trimming and Shearing Line

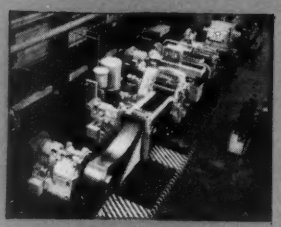


Mechanized Sheet Mill

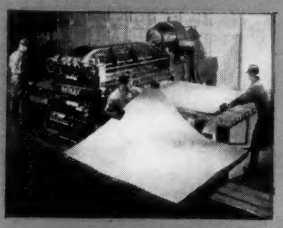
Continuous Strip Pickling Lines



Tin Plate Shearing Line



Electrolytic Line



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CLEVELAND, OHIO

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For 36" Wide Material and Narrower

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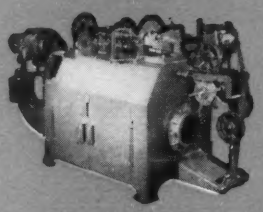
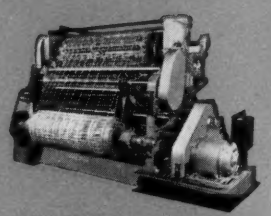
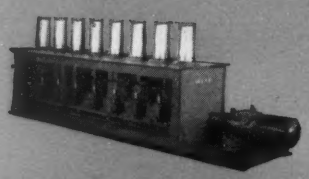
PATENTING · GALVANIZING AND TINNING TAKE-UP FRAMES · WIRE FLATTENING MILLS · SPOOLERS · NAIL GALVANIZING AND BLUEING MACHINES · BARBED WIRE AND FIELD FENCE MACHINES



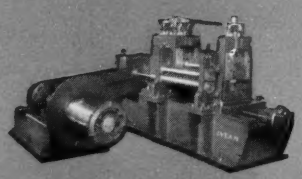
Barbed-Wire Machine



No. 1155 Farm and Field Fence Machine



8 Block Fine Wire Tinning Take-up Frame



Strip Reel and Slitting Unit

HOLMQUIST BARBED WIRE AND WIRE FENCE MACHINERY

16 Block Wire Galvanizing Take-up Frame

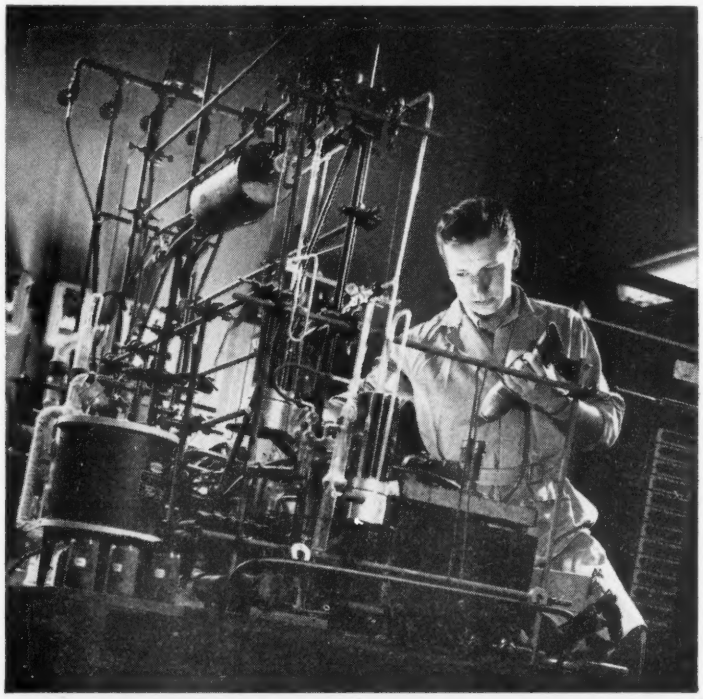
What do CARBOLOY'S 29 quality tests mean to you?

HERE you see a drawing of a 16th-century water-powered wire-drawing apparatus.

Its production requirements were limited: a simple hole in a steel plate served well enough as a die.

But you, today, face intensive competition: your wire, bar, and tubing must be smooth, strong, and accurate. Your costs of die replacement and rejects must be kept down, too.

That's where Carboloy's exhaustive testing comes in—to assure you of dies that help keep the quality of your products *higher*, and your production costs and product prices *low*.



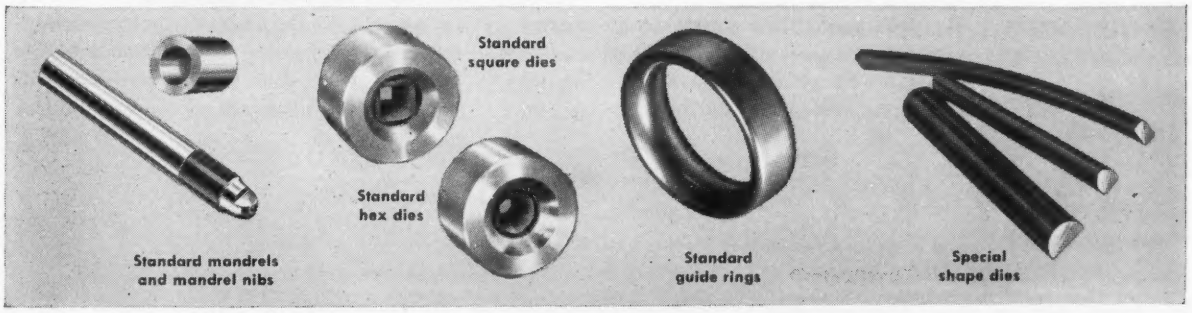
The photograph illustrates one of the 29 tests for quality that Carboloy is subjected to in every phase of manufacture—from powder to die.

Spectrographic, microscopic, and chemical analyses; X-ray diffraction, transverse-rupture, and many other tests, ensure the high chemical purity of your Carboloy dies, and make certain that you get the best mechanical properties for your die needs.

Let us tell you more about these dies—and about Carboloy's extra benefits and assurances of quality. And ask for the Carboloy DIE SERVICE MANUAL D-119.

CARBOLOY COMPANY, INC.
11171 E. 8 MILE BLVD. • DETROIT 32, MICHIGAN

CARBOLOY ®
CEMENTED CARBIDE DIES



BETHLEHEM WIRE is tailor-made

Whether you need steel wire for an everyday use or some special application, we make it to your specifications in our modern wire mills. One kind of wire often serves several, or even a hundred, different purposes. In other cases it might be desirable to use six different kinds of wire for as many applications.

Bethlehem produces a wide range of steel wire . . . low-, medium-, and high-carbon types . . . for cold-heading and forging, for telephone and power-transmission lines, for welding, wire rope, upholstery springs, and many other wire specialties.

In tailoring steel wire to meet your specific needs we carefully control the integrated manufacturing process from the melting of the steel to its final treatment and drawing into wire.

Manufacturers everywhere rely on the uniform quality of Bethlehem wire for its countless uses. Whatever your needs may be, we welcome your invitation to work towards getting best results with your wire products.

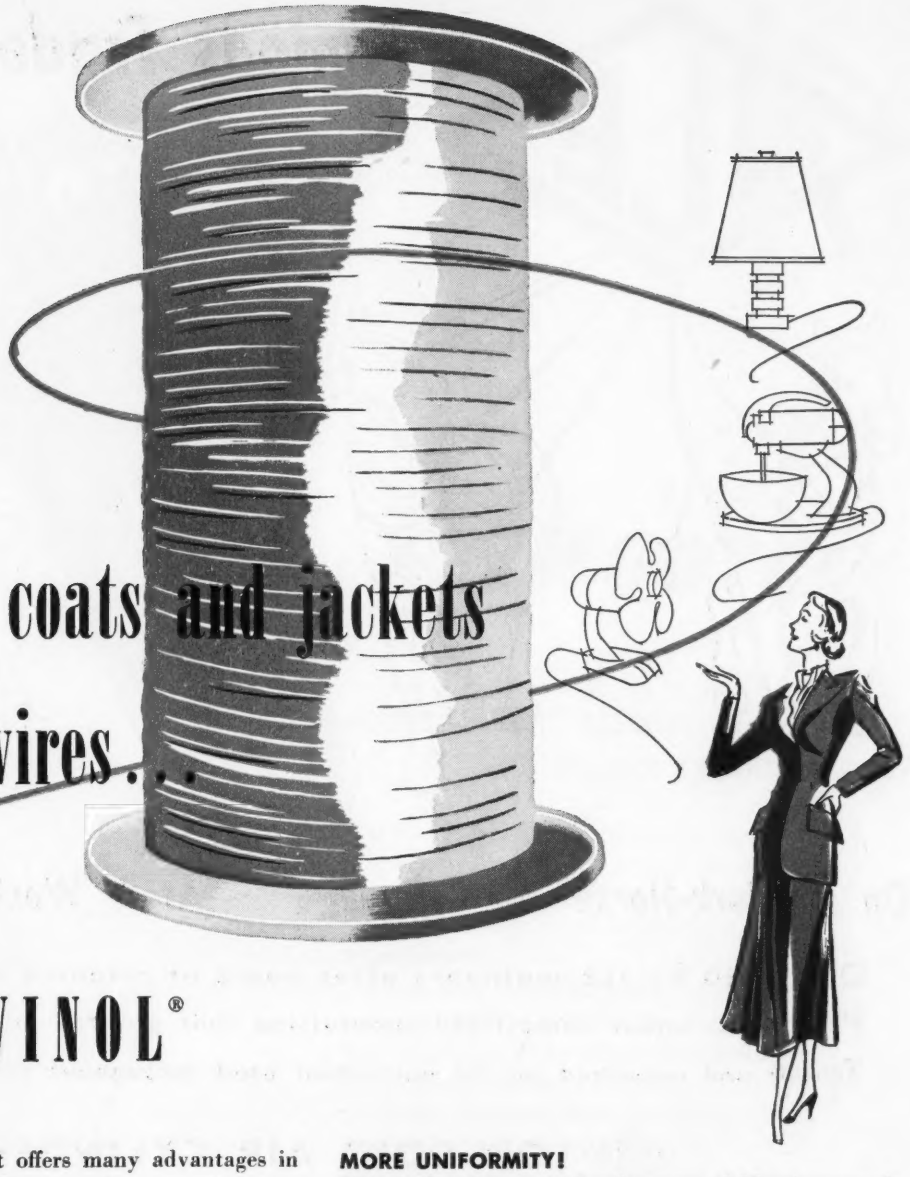
BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

WIRE & WIRE PRDUCTS. Vol. 23, No. 9. September, 1948. Publi:ation Office, at 61 Cliff Street, New York 7, N. Y. Executive Office, 300 Main Street, Stamford, Conn. Published monthly by the Qui:n-Brown Publishing Corp., Richard E. Brown, President; R. S. Spengel, Secy. and Treas. Subscription price: U. S., $5.00; Canada, $5.00 per year; 50 cents per copy; Foreign, $7.50 per year. Entered as second class matter, June 14, 1946, at the Post Office, New York, N. Y., under Act of March 3, 1879.



Better coats and jackets for live wires . . . with MARVINOL®

Here's a vinyl resin that offers many advantages in coats or jackets for wire. For example:

MORE STABILITY! Marvinol offers superior stability in processing and in end products. High molecular weight gives it extra toughness and "dryness" . . . yet it is easy to formulate by extruding, injection molding or other processes . . . is among the most versatile of vinyl resins. Wire covering made from Marvinol has greater resistance to heat and light, greater low temperature flexibility, may be brilliantly or delicately colored, has less heat deformation. Marvinol "coats and jackets" are also highly resistant to oils, acids, foods, aging, wear and other normally destructive factors.

MORE UNIFORMITY!
Marvinol resins are a development of Martin research and Martin's quarter-century of plastics experience. They're being produced in the world's most modern chemical plant to assure unexcelled uniformity. The Glenn L. Martin Company, maker of Marvinol, does not compound or fabricate in the plastics field. If you coat wire, our sales engineers and customer service laboratory offer full technical cooperation. If you buy or use finished wire, ask your supplier about Marvinol. Write on your company letterhead to: Chemicals Division, Dept. W-9, The Glenn L. Martin Company, Baltimore 3, Maryland.

Martin ★ Marvinol

Resins, Plasticizers and Stabilizers Produced by the Chemicals Division of
THE GLENN L. MARTIN COMPANY—AN INTERNATIONAL INSTITUTION
"Better Products, Greater Progress, Are Made by Martin."

A Famous Trademark...

On A "Work-Horse" Air Cylinder At A "Work-Horse" Price!

DESIGNED by JLE engineers after years of research in pneumatics!

PRODUCED under same rigid supervision that governs all JLE equipment!

TESTED and approved on JLE equipment used throughout the wire industry!

LOW-COST AIR CYLINDER FEATURES

1. Available in standard bore sizes from 1½" to 10" diameter. Can be made in any stroke specified. Has top operating pressure of 110 lbs. per sq. inch.
2. Available in four standard mountings. Standard piston rod attachments available.
3. Can be furnished single or double-acting.
4. Cushioning can be supplied on either one or both ends, if desired.

Ask for complete JLE Air Cylinder details and prices —

JAMES L. ENTWISTLE CO.

43 CHURCH STREET, PAWTUCKET, RHODE ISLAND

30 YEARS OF SERVICE TO THE WIRE INDUSTRY

Canadian Representatives:
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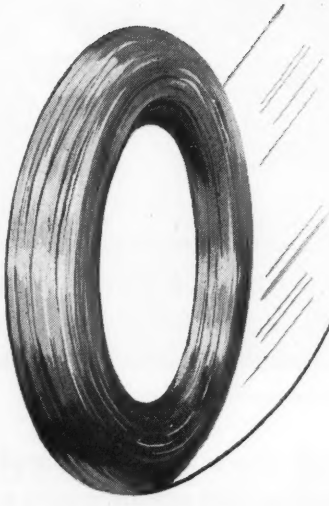
CHASE BRASS and BRONZE WIRE

won't **TWIST**... uncoils **SMOOTHLY**



PERFECT "CAST" ASSURES A PERFECT PRODUCT!

IN the Chase mills very special attention is given to the "cast" of copper alloy wire. Stresses that cause non-uniform uncoiling and twisting are eliminated by extreme care in manufacture.

Chase wire for cold-heading or extruding or to be otherwise plastically formed will flow uniformly. You can thus be sure of a perfect product. And many critical tests on Chase wire take place every day, to assure you bright, beautifully clean wire of even temper . . . wire free from physical defects, accurate in dimensions.

Chase regularly makes 22 different alloys in wire form to suit your every need. Call your nearest Chase Warehouse or Service Office for complete information.

Chase *the Nation's Headquarters for* BRASS & COPPER

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THIS IS THE CHASE NETWORK . . . *handiest way to buy brass*

ALBANY† ATLANTA BALTIMORE BOSTON CHICAGO CINCINNATI CLEVELAND DETROIT HOUSTON† INDIANAPOLIS KANSAS CITY, MO. LOS ANGELES MILWAUKEE MINNEAPOLIS NEWARK NEW ORLEANS NEW YORK PHILADELPHIA PITTSBURGH PROVIDENCE ROCHESTER† SAN FRANCISCO SEATTLE ST. LOUIS WATERBURY (†Indicates Sales Office Only)

Testing G-E cable tape for thickness and evenness.

You can depend on G-E Cable Tape because it's "QUALITY TESTED"

G-E CABLE TAPE MUST PASS 5 TESTS

1. G-E cable tape is carefully tested for thickness, and evenness of application of high-quality insulating varnishes.

2. G-E cable tape shows excellent dielectric strength by meeting a break-down voltage of 1000 volts per mil at room temperature. In oven tests, G-E cable tapes meet or exceed a break-down voltage of 750 volts per mil at 85 C.

3. Heat testing subjects G-E cable tape to 125C for many hours, with periodic checks for brittleness by bending the tape around an ⅛ inch mandrel.

4. G-E cable tape passes the test for tensile strength by standing a pull of 3000 pounds per square inch, much more than specifications require.

5. G-E cable tape meets and exceeds the established specification for tearing strength, thereby ensuring good mechanical strength.

● Each lot of G-E cable tape is tested in a modern control laboratory for the important electrical and insulating properties. Using I.P.C.E.A. specifications as a guide, the laboratory makes sure that G-E cable tapes meet or exceed those standards.

Exhaustive tests have proven that the important properties of an outstanding cable tape are present in G-E tape—dielectric strength, tensile strength, tearing strength, resistance to heat and weathering—all qualities which are vital in a quality insulation.

For further details write to Section CG-9, Resin and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, N. Y.

CABLE TAPE

GENERAL ELECTRIC

CD48-T1

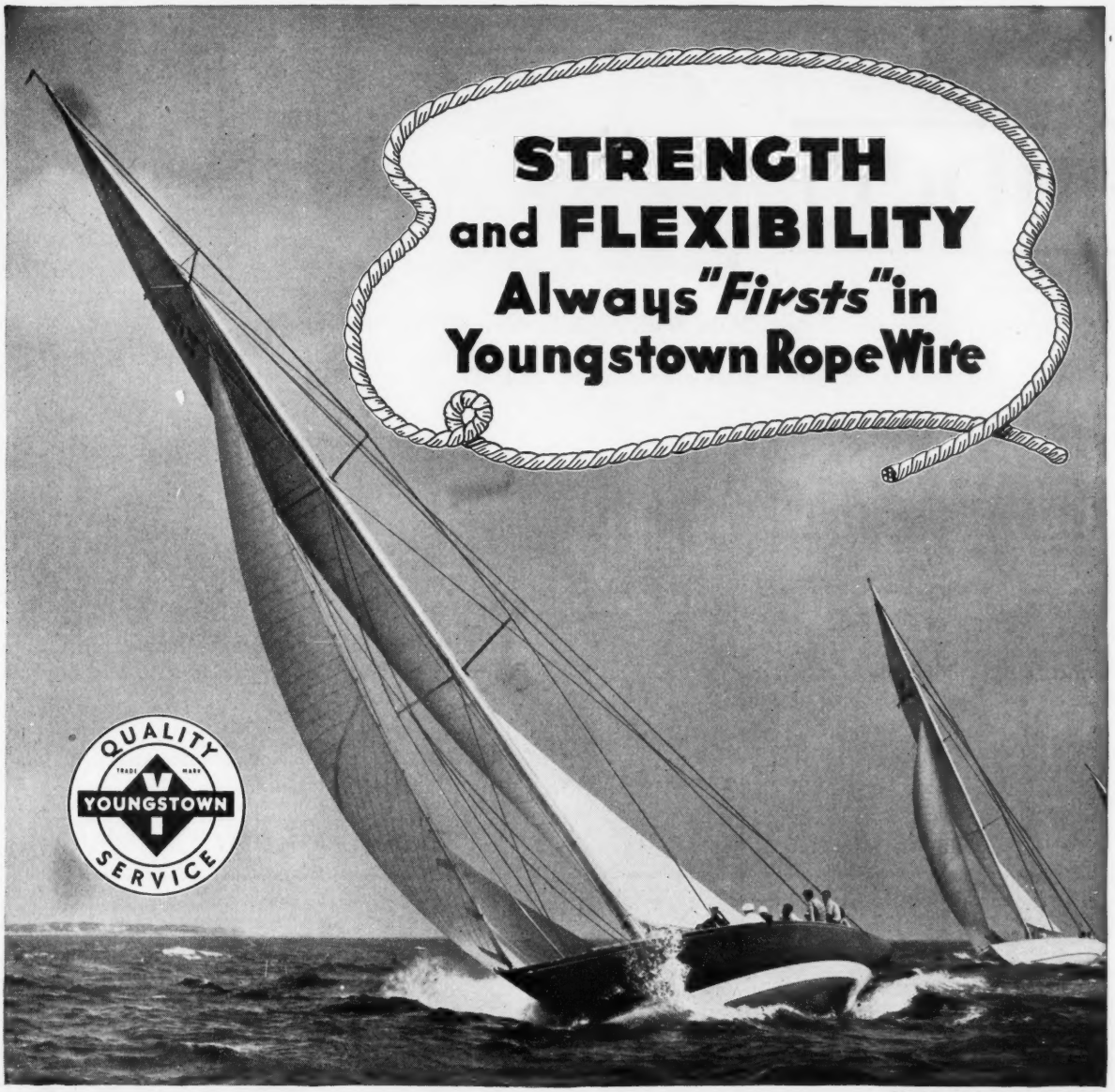

Photo by courtesy of the Preformed Wire Rope Information Bureau.

Where Cups Are Won

HIGH strength and flexibility...minimum stretch...toughness to resist abrasion... ABILITY TO RESIST CORROSION...these are prerequisites in the rigging of a champion.

In galvanized wire rope, these essential properties start with the wire from which the rope is made. When it's woven from Yolectro High Carbon Galvanized Rope Wire, ropemaker and user alike can be confident of its superiority.

Yolectro High Carbon Rope Wire is produced from the finest steel, refined, rolled and drawn to exacting specifications. Its chemical and metallurgical characteristics are designed for adequate strength, flexibility, toughness and corrosion resistance--in proper balance to meet the conditions under which wire rope must serve. Yolectro Galvanized High Carbon Rope Wire is coated with the purest and highest grade zinc obtainable. As in all Youngstown wire mill products, you are sure of controlled high quality in Yolectro High Carbon Galvanized Rope Wire.

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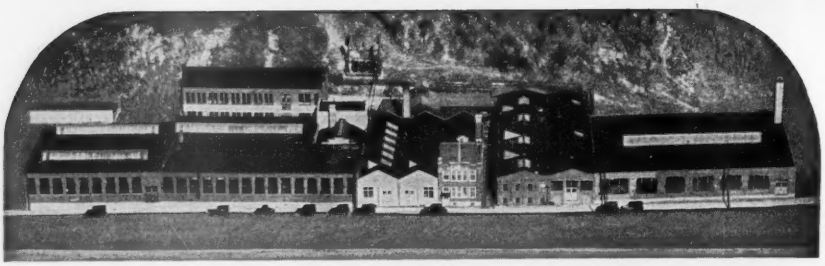
HUDCO



HUDSON WIRE CO. PLANT AT OSSINING, N. Y.

This plant is one of the most up-to-date and completely equipped plants in the world for the production of "HUDCO" fine wires in all metals.

ESTABLISHED IN 1902

HUDCO

WIRES FOR METAL SPRAYING

Pure lead, Lead Alloy, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire. High Conductivity, Electric Wire. Cadmium, Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze, Brush Wires, Crimp and Straight, Brass, Steel, Nickel Silver, Copper and Phosphor Bronze.

HUDCO

FINE BARE WIRES

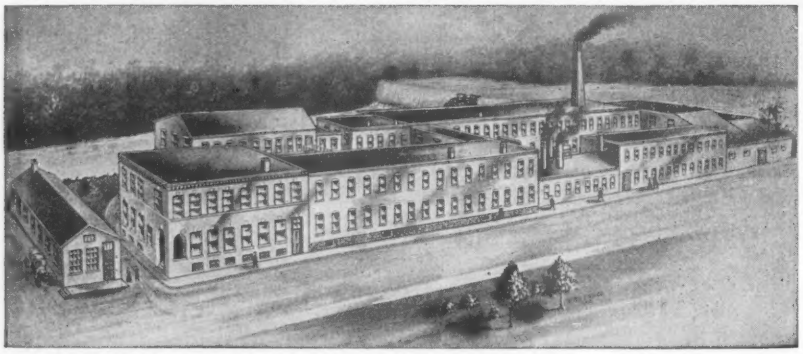
High Brass, Low Brass, Zinz 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper. Cadmium, Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Send Us Your Specifications and Let Us Quote Prices

HUDSON WIRE COMPANY • OSSINING, N. Y.



Winsted Division of HUDSON WIRE CO. at Winsted, Conn., modern and completely equiped enamelled wire plant for LEAKPROOF ENAMELLED WIRE and all standard and special coverings.

WINCO

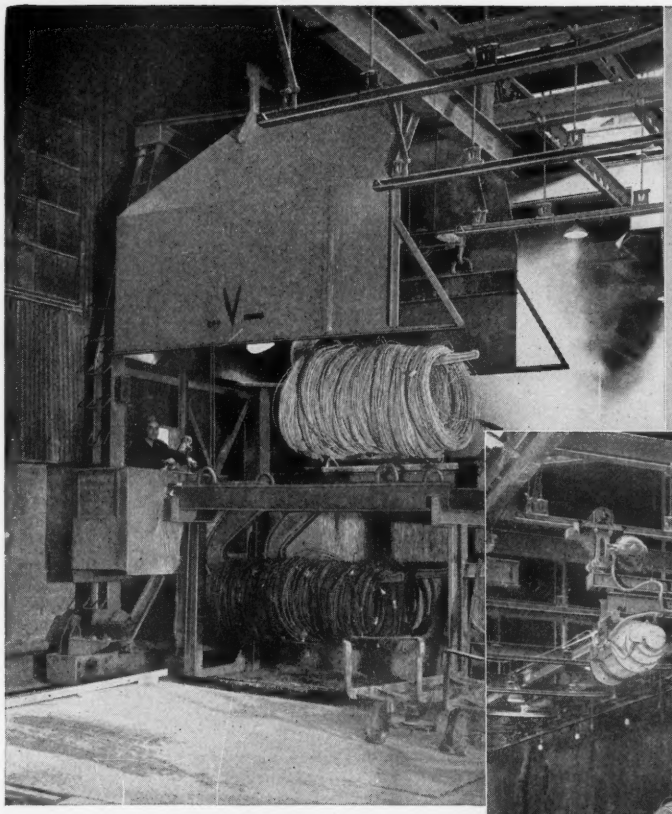
"WINCO" enamelled wire is drawn from special selected copper, assuring perfect enamelling. All wire tested before shipment.

"WINCO" enamelled wire is available in all standard and special coverings made to meet exacting requirements.

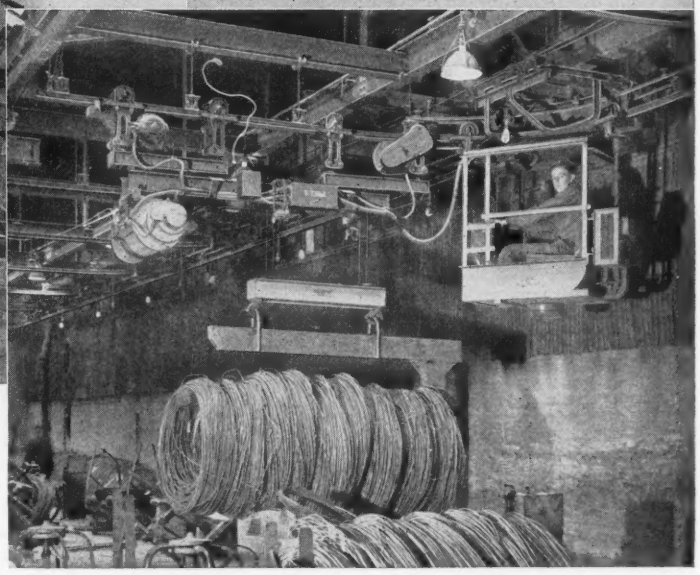
Samples of LEAKPROOF and other enamelled wires sent on request

WINSTED DIVISION OF HUDSON WIRE COMPANY

WINSTED, CONN.



PRODUCTION *in all Departments of Wire Mill* SPEEDED



Above—One of two Cleveland Tramrail gantry cranes in the cleaning house. If worked three shifts a day, this crane can clean 350 tons of rod, as it handles 2700 to 3000 lbs. at a time.

•

Right — This Cleveland Tramrail cab-operated carrier transports heavy loads between the various departments on the overhead Tramrail system.

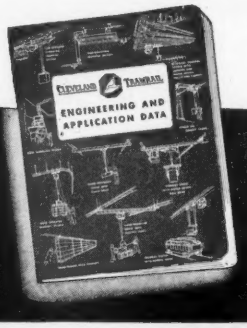
...at The Steel Company of Canada

Cleveland Tramrail overhead materials handling equipment unloads the rod from incoming railroad cars and delivers it to storage. It speeds it through the various cleaning house operations. It conveys the rod to the drawing blocks, strips them, and hauls the wire away. It serves every department of the large wire mill of The Steel Company of Canada in Hamilton, Ontario.

Plant efficiency is greatly improved with Cleveland Tramrail equipment. It provides interdepartmental handling without the need of wide aisles and thus permits a larger percentage of the floor area being devoted to manufacturing. Damage to materials and equipment is reduced.

In the cleaning house Cleveland Tramrail enforces cleanliness, orderliness, and better working conditions, and lowers the cleaning cost per ton. Cleveland Tramrail block-stripping cranes and carriers make possible the drawing of heavier bundles and enables a man to take care of more blocks, thus speeding wire-drawing.

Now is the time to thoroughly study your methods and equipment. Cleveland Tramrail engineers will gladly co-operate with you.



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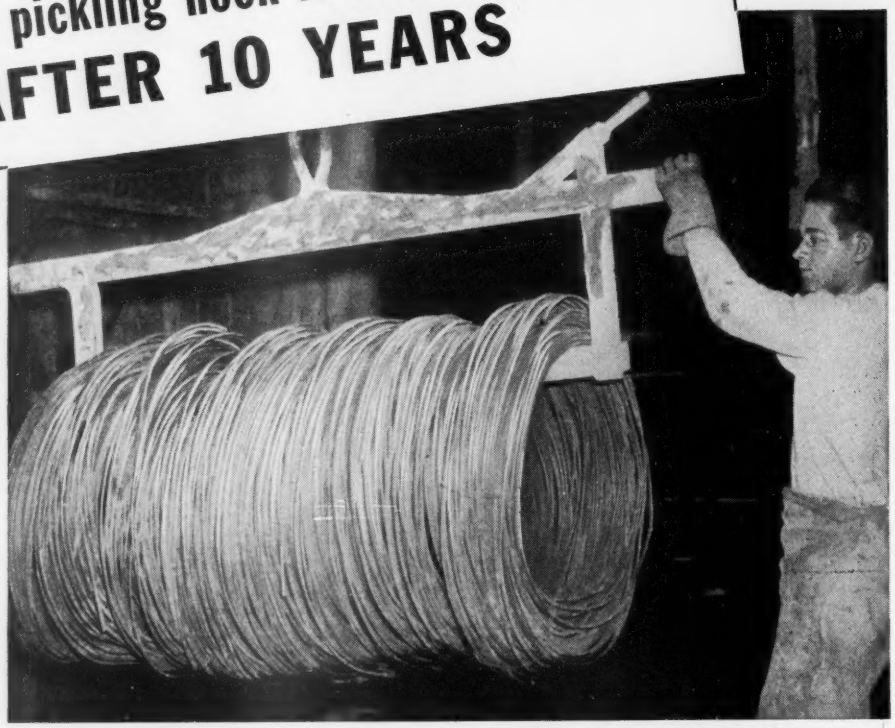
CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
9210 EAST 288TH ST. WICKLIFFE, OHIO.

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

Why this pickling hook is still in service AFTER 10 YEARS



These MONEL pickling hooks have handled coiled wire in pickling solutions—a ton at a time—for more than ten years, *and are still in service.* They are installed at the Birmingham mill of Lamson & Sessions.

More than a decade ago, Lamson & Sessions purchased MONEL* pickling hooks for service in their Birmingham, Alabama mill. The hooks were to be used in pickling coiled wire—a ton at a time.

Today, 10 years later, those same pickling hooks are still in service.

This is an outstanding service record—but users of MONEL pickling equipment know that it is not an unusual one. For MONEL is an alloy with a combination of properties that make it a *preferred* metal for pickling equipment.

★ ***High resistance to corrosion:*** **Hot pickling solutions have no appreciable effect on MONEL.**

★ ***High strength.*** **MONEL is stronger than structural steel. You can make your equipment *lighter* without sacrificing strength, which means increased pay loads.**

★ ***Hardness, toughness.*** **MONEL's resistance to abrasion cuts down on wear at critical friction points.**

★ ***Good Workability.*** **MONEL can be machined, formed, and welded, without special equipment. And what is extremely important in pickling applications, MONEL welds are *corrosion-resistant.***

★ ***Availability.*** **Your nearest INCO distributor stocks MONEL in standard mill forms such as sheet, bar, rod, wire, and tubing. MONEL screws, bolts, and rivets are also stocked in commonly-used sizes. If you prefer to have your pickling equipment made for you, many of the nation's leading fabricators are experts in handling INCO Nickel Alloys. A letter to INCO will bring you a list of these established fabricators.**

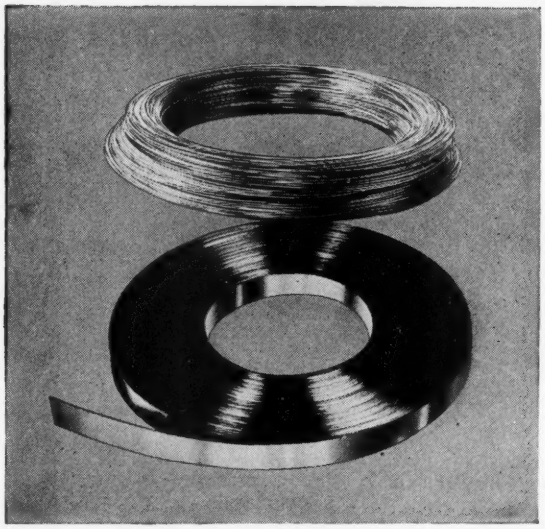
If you are contemplating new pickling equipment or planning to rebuild old installations, you will want to know more about MONEL. Our Technical Service Department will gladly make recommendations based on test data and the experience of other concerns. Why not write—today—and ask for your free copy of *Where Monel Pays Its Way in Pickling?*

*Reg. U. S. Pat. Off.

MONEL
FOR MINIMUM MAINTENANCE

EMBLEM OF SERVICE
INCO
TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N.Y.



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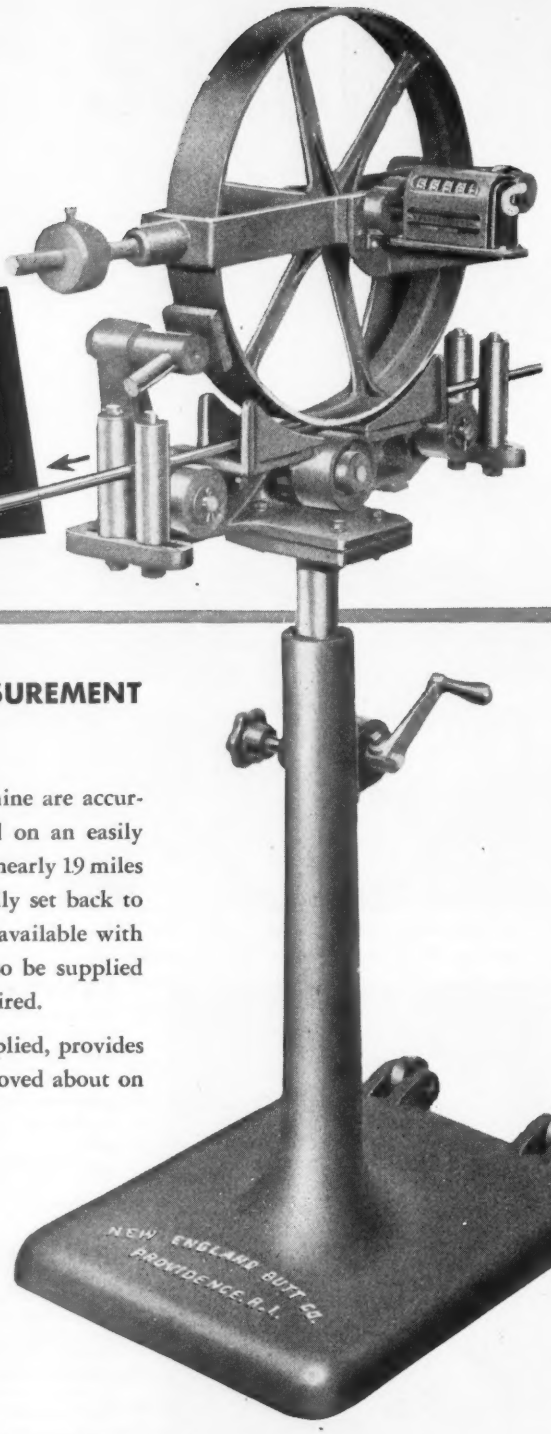

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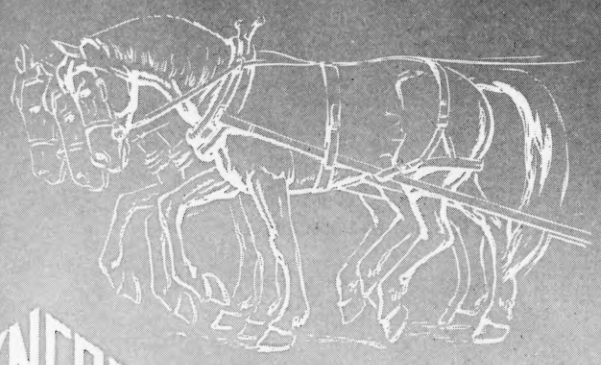

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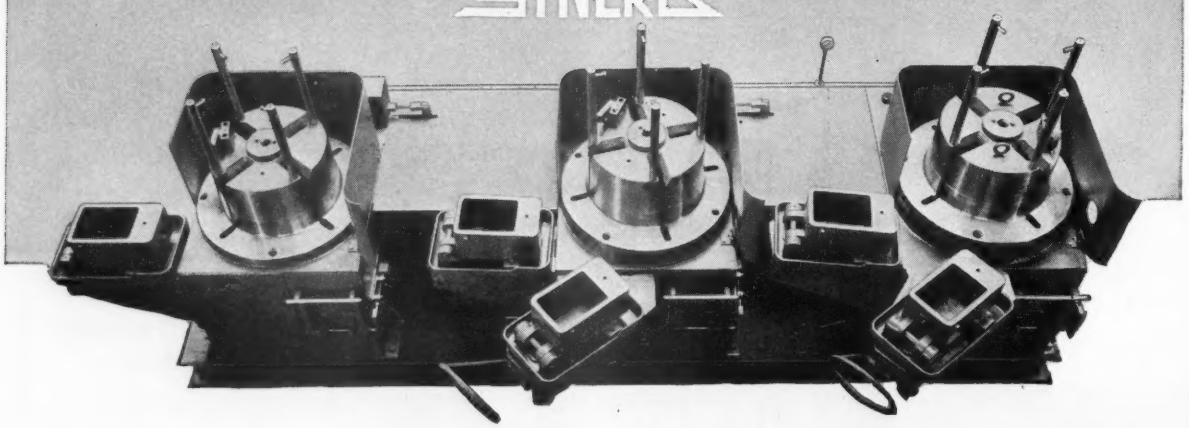

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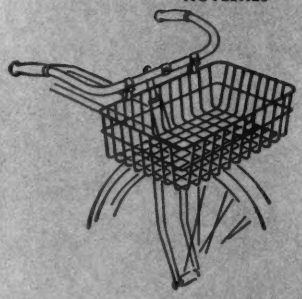

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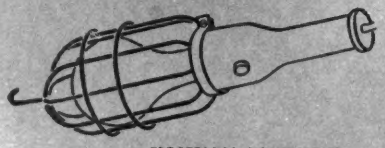

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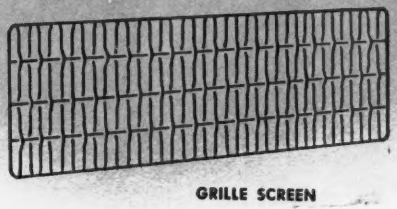

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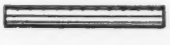
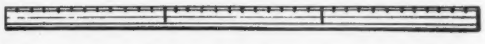


BECOMES A YARD



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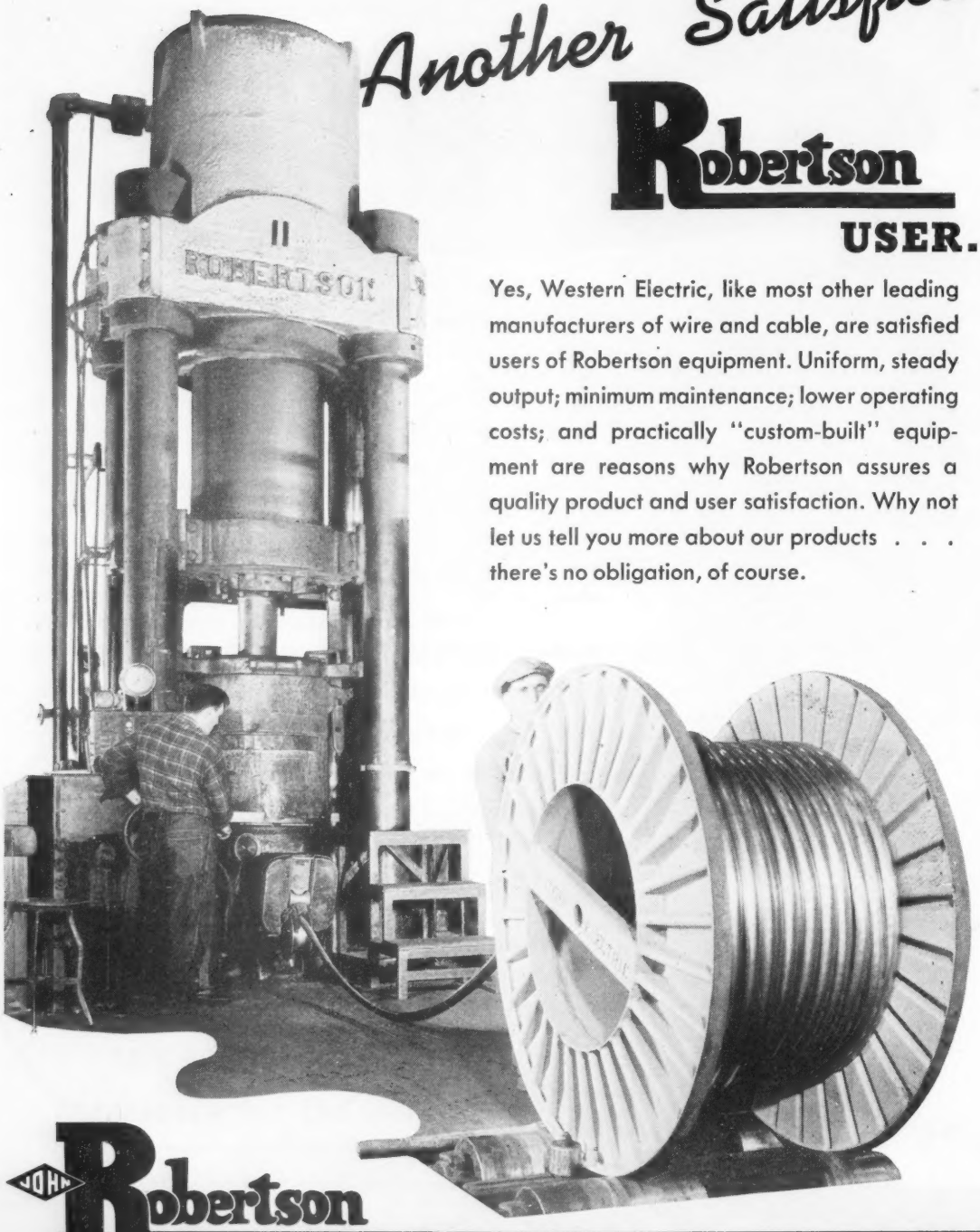

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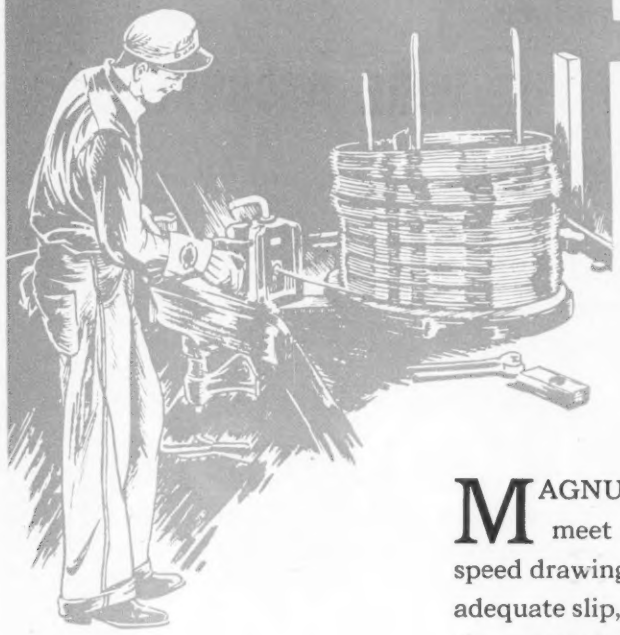

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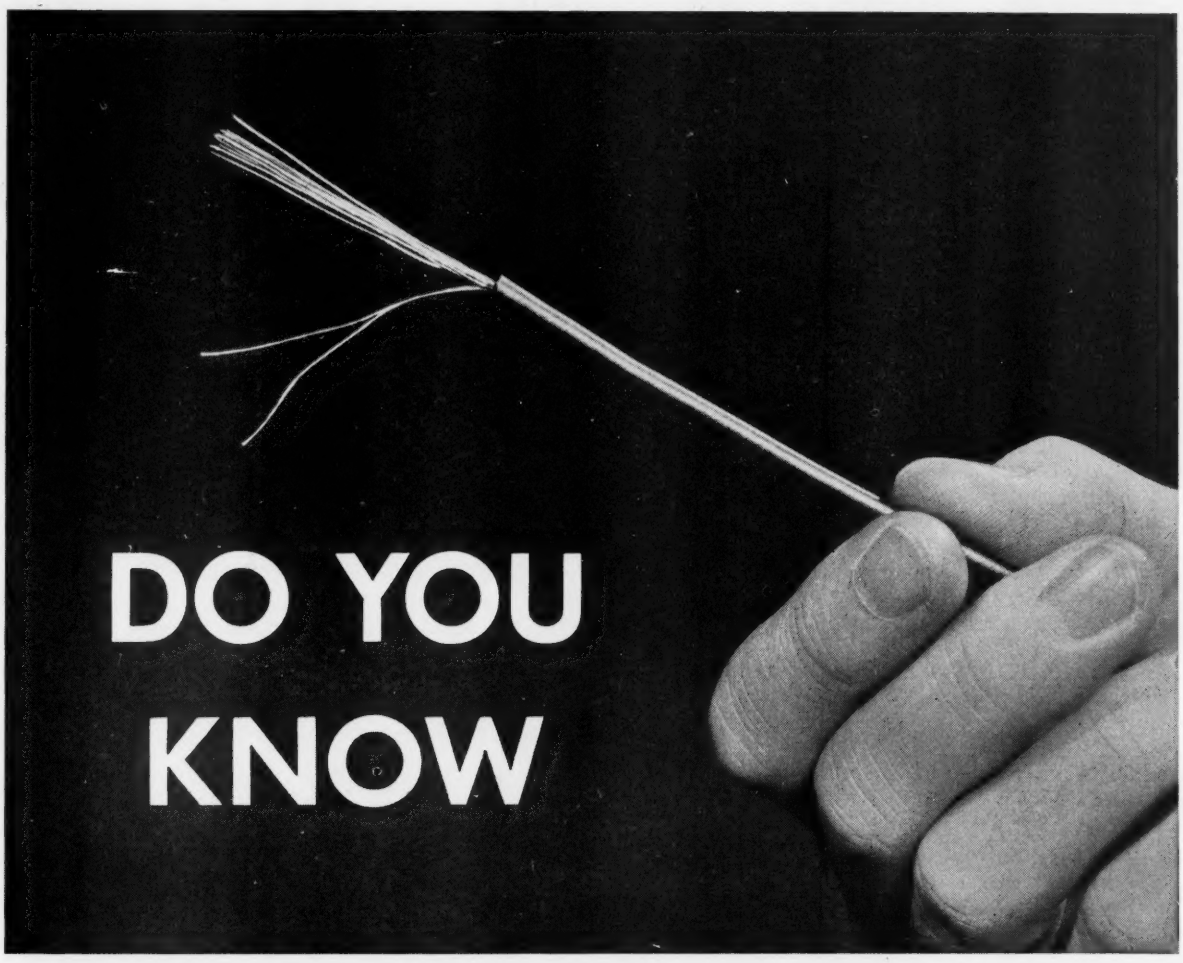

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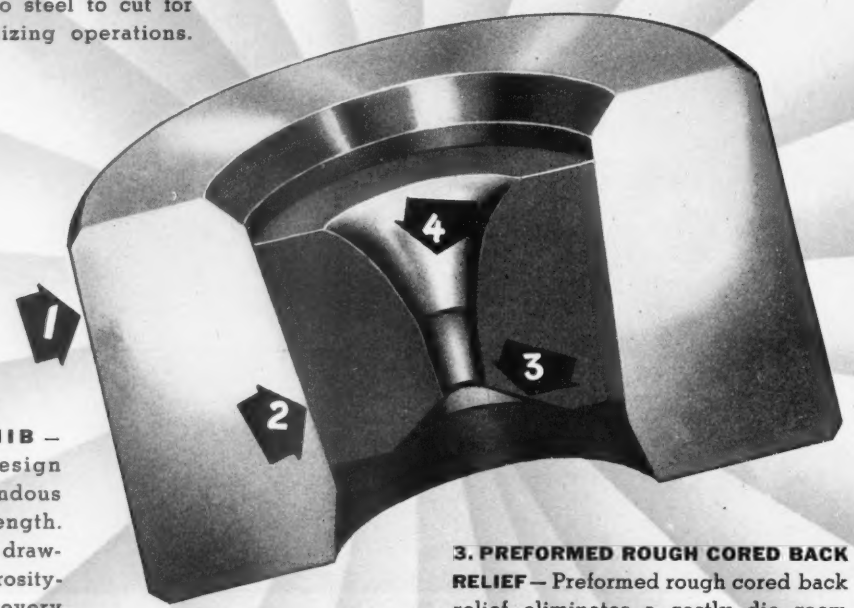

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The Wire Outlook

It did not take long for the wave of industrial wage increases to become reflected in a general upsurge of prices for basic materials and for many consumer items. While it is hoped that the 1948 wage-price cycle will be the last for some time, it is almost too much to hope that the labor generals have learned anything from the last three rounds — they probably know of, but choose to ignore, the inexorable functioning of economic law.

While the general level of business activity has been high, about 11% over a year ago, strikes, vacations, and summer shut-downs have reduced the year's potential production levels. We have a 90 million ton steel ingot capacity. Late estimates indicate actual production of not more than 65 million tons for the next twelve months. 20 million of this will go for special government projects, leaving 45 million for industrial consumption — approximately 15% less than was available for the preceding twelve-month period.

The real pinch of defense operations, as applied to steel, may not be felt for six months or so. This does not mean that manufacturers will not be busy, but it does indicate that emphasis will build up again on defense material, creating an ever-increasing shortage of consumer goods until such time as Russia ceases to be a menace to the freedom and peace of the world. The shortages that will be felt in steel will also become apparent in copper, lead, tin and zinc in 1949. The availability of adequate supplies of steel is always the keystone in the arch of our economic prosperity.

Scrap, along with other things, has gone up in price and a scramble to buy it has helped the trend. Some mills are asking their customers to return scrap direct to them. The need for scrap in steel-making is important and users should make every effort to cooperate.

Price increases on many wire products are being made as the new basic brass, copper, aluminum and steel take effect. Non-integrated wire mills are having to pay $12 a ton more for rods than before.

Screw stock demand is heavy, although the demand for screws has abated somewhat and backlogs are being reduced. Welding rods have increased in demand and cold heading and nail wire are hard to secure. This is understandable, when one considers that the June building volume reached $1,605,000,000, $625,000,000 of which was for private housing. This is 9% over May and 54% higher than June, 1947.

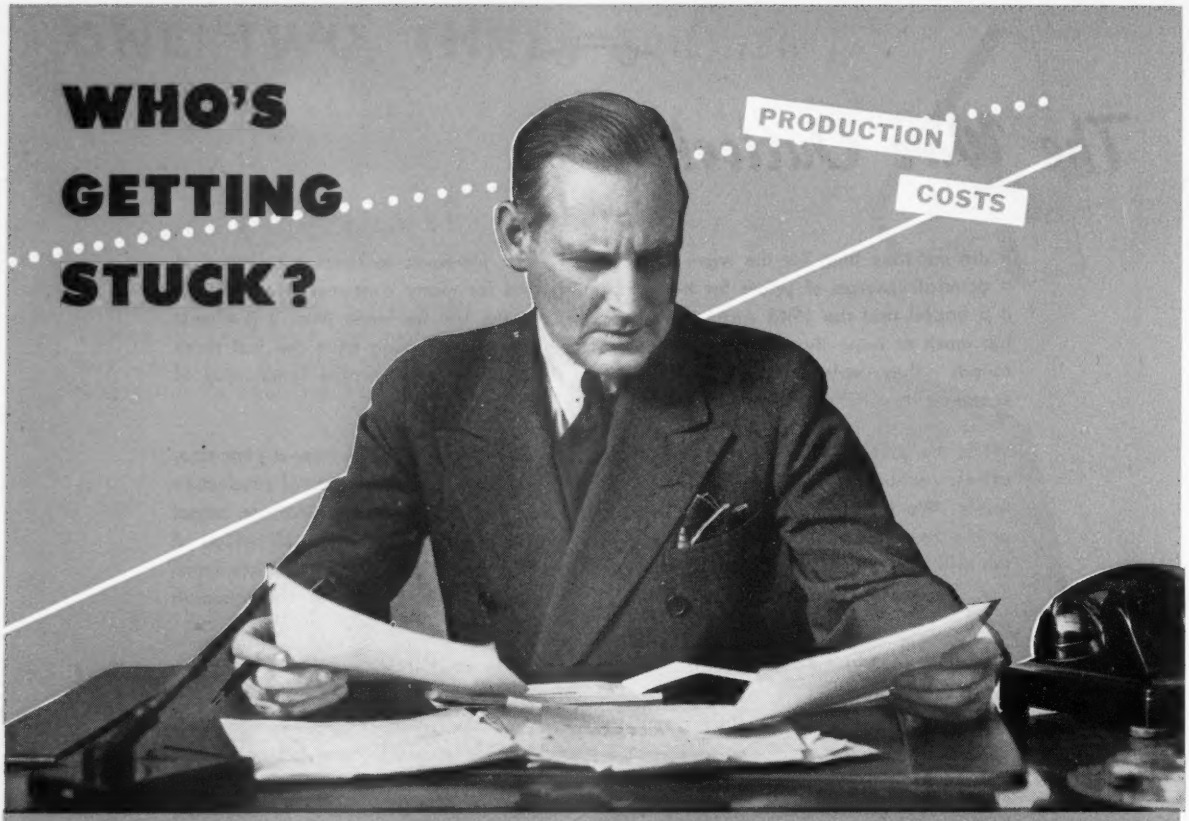
Most wire products are in short supply, with one notable exception — rope. Music and spring wire are strong, but the pressure for deliveries is not as heavy as it was last Spring.

Certainly, business is facing major problems, the least of which is election-year confusion, which in 1948 yields first place to other questions. Principal among these are the Supreme Court's decision on the base pricing system and the threat of war. The first, unless altered, may cause a re-location of industrial plants on a wide-scale basis and the second will again throw our economy out of gear for its duration.

It is to be hoped that the first may be corrected and the second avoided, if it can be done without sacrificing the ultimate peace of the world. This is surely a day for forthright and cool courage, whatever may come.

—from the Editor's Desk

WHO'S GETTING STUCK?



Wages are up . . . taxes are up . . . material costs are up . . . *all* costs are up. Are *you* getting a compensating gain in production? If not, it's high time to talk to a Morgan engineer. Let him tell you what you might expect from new, modern

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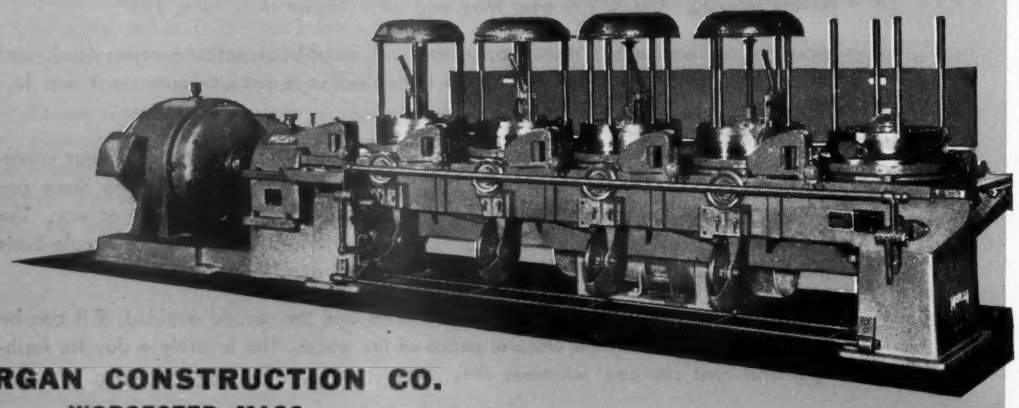

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A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 23 SEPTEMBER, 1948 No. 9

Designated as
Official Publication By The Wire Association

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— ASSOCIATE EDITORS —
Kenneth B. Lewis, Consulting Wire Mill Engineer
Lancaster, Allwine & Rommel, Consultants on Patent Information

Richard E. Brown, General Manager
R. S. Spangel, Business Manager
E. D. Sickels, Advertising Manager

Publication Office: New York
Executive Office: Stamford Trust Co. Bldg., 300 Main St., Stamford, Conn.

Annual Subscription, U. S. $5.00, Canada $5.00

50 Cents a Copy in U. S. Issued Monthly Foreign, $7.50
October Convention Issue $1.00 a Copy
January Convention Discussions Issue $1.00 a Copy

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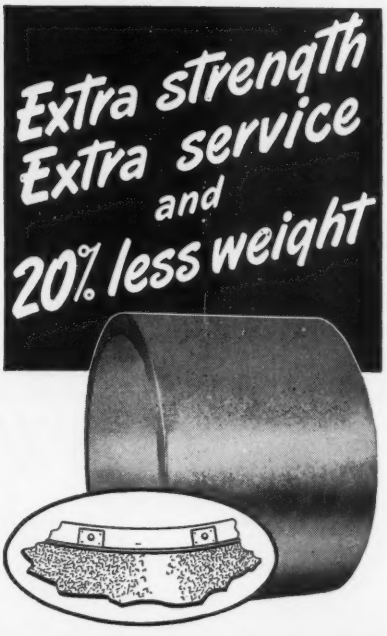

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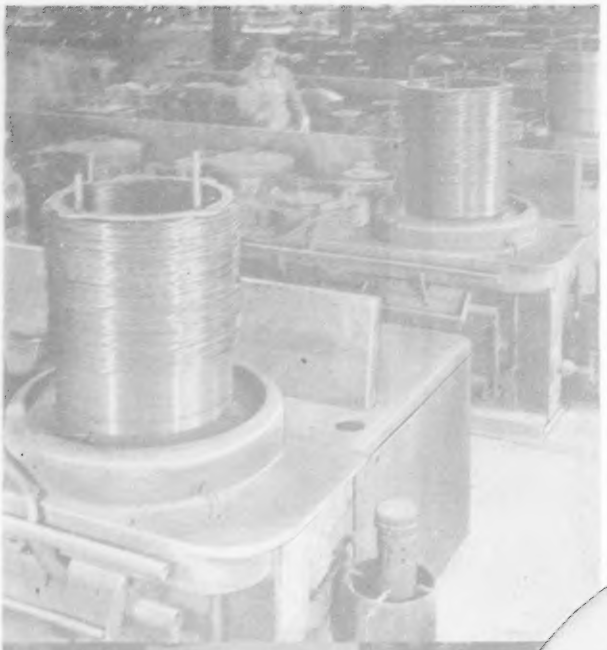

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WIRE
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A monthly publication devoted to the production of Wire, Rod and Strip.
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Vol. 23 SEPTEMBER, 1948 No. 9

Conditions in the Pickling Bath Which Affect Hydrogen Embrittlement

By C. A. Zapffe and M. E. Haslem
Consulting Metallurgist Research Chemist
Baltimore, Md.

With this article there is finished a series representing, perhaps, the most complete and last minute coverage of the important phase of hydrogen in steel obtainable. The surprising information on the relation of the inhibitor to hydrogen absorption is one of the front research problems in the field today and one which will be heard of a great deal in the future.

Introduction

IN this Journal, previous publications from this laboratory have described a quantitative test for hydrogen embrittlement of wire and have discussed numerous factors affecting brittleness from electroplating and from cathodic pickling (Feb. 1946, May 1947, June 1948, July 1948).

* * *

IN the wire industry, however, straight acid pickling has broader interest than the electrolytic processes; and discussion often develops over comparisons of sulfuric and hydrochloric acids, of inhibited and uninhibited acids, of mixed acids, of concentration and temperature. These are the subjects of the present paper.

* * *

FURTHERMORE, the factors controlling hydrogen absorption during electroplating and cathodic pickling, discussed heretofore, do not necessarily control absorption during straight acid pickling. For example, a previous paper demonstrated that cathodic cleaning provides the same degree of embrittlement whether an acid or alkaline electrolyte is used. In chemical cleaning, such an equality obviously does not exist because of marked differences in the rate of the chemical attack which produces the hydrogen; and it becomes important to learn whether cleaning with one acid or another leads to greater or to less liability to hydrogen-caused defects.

* * *

AGAIN, there was demonstrated in a previous paper that certain acid pickling "inhibitors" added to a cathodic pickling solution actually **increase** embrittlement. The possibility of such an effect in straight acid pickling, for which inhibitors are designed, should be worth investigating, indeed.

* * *

IN the wire mill. acid pickling is common for cleaning annealed coils previous to drawing through the dies, and any factor increasing the liability to breakage in the die or during coiling or fabricating operations is important to study. In the customer's shop, steel wire and acid come in contact under conditions varying from acid pickling and cleaning down to the flux in soldering. Breakage, particularly of hardened parts, is often a nuisance, and sometimes a matter of real concern. The nature of any phenomenon causing such damage is advisedly explored; and, as shall be demonstrated, there are some most important factors in pickling brittleness which have heretofore gone unrecognized.

* * *

Test Procedure

TO study these factors which control hydrogen absorption and embrittlement from acid pickling, the constant-rate single-bend test was used as described in a previous paper (May 1947). Duplicate wire specimens 4-inches long were cleaned with 120-grit emery paper previous to pickling. This technique should be noted, since in industry the wire enters the pickling bath with an oxide coating, which is removed when cleaned. The values determined here are therefore **maximum** values for embrittlement.

***From work performed in the laboratory of the senior author in conjuction with an Office of Naval Research contract on basic studies of gas-metal systems.**

HOWEVER, the technique of pre-cleaning the specimen is not only necessary for obtaining reproducible and significant results, but the **maximum values are actually the values of practical interest.** Breakage requires only one small locus of embrittlement; and every opening in the scale during commercial pickling and cleaning provides just such a "pre-cleaned" locus.

* * *

AS in the previous research, Type 440-C stainless steel wire (17% chromium — 1% carbon) was used because its sensitivity to hydrogen embrittlement makes it a good indicator for the effects of the gas. Two coils from different heats were used, one serving for the study of uninhibited acid, and the other for the study of inhibited acid. In addition, a mild steel wire was used in some tests for purposes of comparing alloyed with unalloyed steel. Obviously, the resistance of stainless steel to chemical attack in some solutions would obscure its sensitivity to hydrogen embrittlement. Without chemical attack, no hydrogen atoms are produced in straight acid pickling; and one's experience with unalloyed steel therefore cannot be applied directly to problems with alloyed steel, and vice versa.

* * *

THIS statement must be particularly emphasized with respect to the unusual results with inhibitors reported in the latter part of the paper, for the data there refer specifically to the pickling of stainless steel. The problem with carbon steel has its own characteristics in turn, and will be reported upon separately in a paper before the Fall meeting of the Wire Association.

* * *

THE steels used in the present research are described in detail in Table I.

TABLE I
DESCRIPTION OF SPECIMENS

Coil No.	Wire Size (ø in ins.)	Grade	Analysis	Thermal Treat.	Mech. Treat.	Ult. Tensile Str. (psi.)
I	0.62	S.A.E. 1020	C = .18 Mn = .60 Si = .17	Normalized	#5-ga. green rod drawn 6 holes to .62"ø	170,000
II	.059	I.S.I. 440-C	Cr = 17.08 C = 1.08 S = .016 P = .016 Si = .15 Mn = .48 Ni = .28 Mo = .52	Laboratory Full-Anneal (in argon) 1650° - 4 hrs. Cooled 25° - 30°/hr. to 1100° F. Cooled to room temp. in 1 hr.	None	101,500/103,500 (BHN = 176/182)
III	0.62	I.S.I. 440-C	Cr = 17.46 C = 1.01 Ni = 0.50 Mn = 0.34 Si = 0.48 P = 0.021 S = 0.024	Mill Anneal 1550° F - 3 hrs. 25°/½ hr. to 1200° F. Air cool	None	100,000/105,000 (BHN = 215-240)

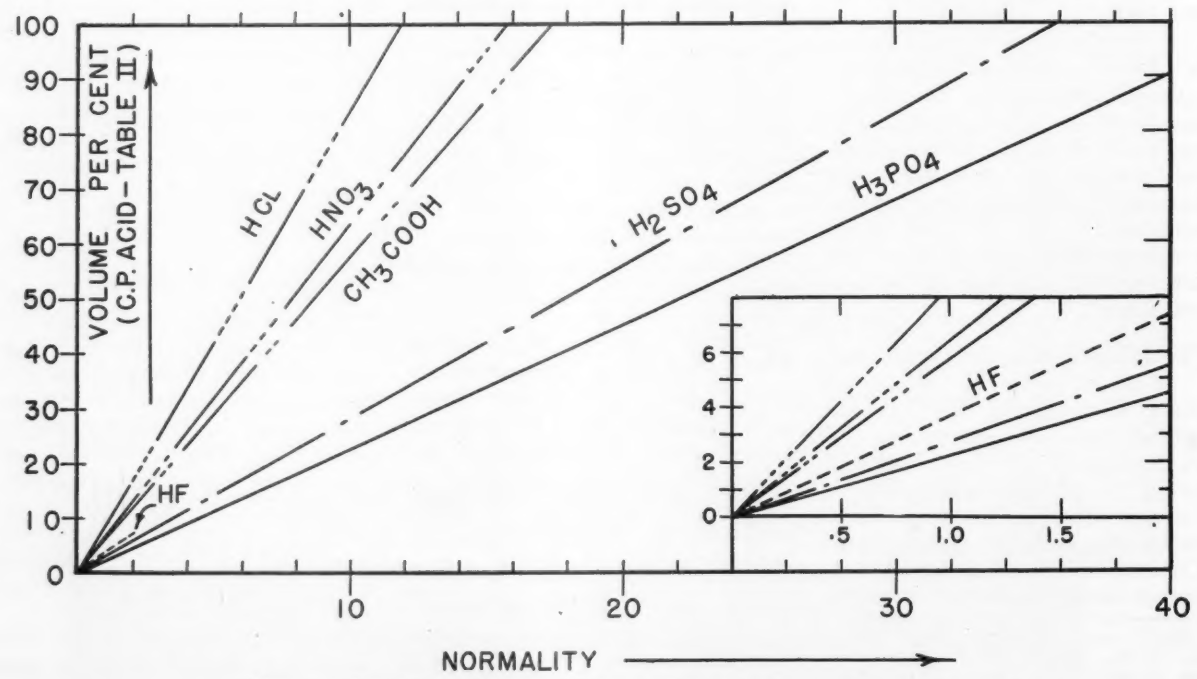

Figure 1. — Chart for conversion of normality to volume per cent. * * *

AS for the acids that were studied, their description stands in Table II.

* * *

AFTER the pickling treatment, the wires were immersed in ice water to slow up spontaneous recovery and to standardize the temperature at which the test is begun. One wire was tested 30 seconds after immersion, the other 90 seconds. On the following graphs, unless noted otherwise, the duplicate 90-second specimen is represented by a smaller circle, or cross; and the stainless teel is represented by circles, the mild steel by black dots.

Effect of Acid Type and Concentration*

CONCENTRATION will be expressed here in terms of normality, which can be readily converted to volume percent by the graph in Figure 1. Specimens are Coils I and II in the preceding Table.

* * *

IN Figures 2 and 3 one sees that H_2SO_4 (sulfuric) and HCI (hydrochloric) cause virtually identical embrittlement for either stainless or mild steel. This, then, is the answer to frequent arguments over the comparison of these two acids.

* * *

AT concentrations above 10-normal, however, H_2SO_4 becomes passivating to stainless steel, causing the bend to return to 180°. The embrittlement of the mild steel also lessens at these high concentrations. but probably for the reason that the degree of ionization in such concentrated solutions is extremely low. The production of hydrogen is accordingly a minimum.

* * *

IN Figures 4, 5 and 6 the tests are extended to phosphoric (H_3PO_4), acetic (CH_3COOH), and hydrofluoric (HF) acids. The effect of ionization now more clearly shows itself. for higher concentrations of H_3PO_4 (a weakly ionized acid) are required to initiate measurable embrittlement; and still higher concentrations are necessary for CH_3COOH (a very weakly ionized acid). Once embrittlement begins, however, it

*From a paper presented to the American Society for Metals in 1946. See Ref. 1.

TABLE II

DESCRIPTION OF ACIDS

*Acid	Specific Gravity	Concentration in Percent by Weight	Concentration in Degrees Baumé
H_2SO_4 (sulfuric)	1.84	95.5 to 97.5	66
HC1 (hydrochloric)	1.19	36.7	22.8
CH_3COOH (acetic)	1.05	99.5	7.1
H_3PO_4 (phosphoric)	1.71	85	60
HF (hydrofluoric)	1.15	48	—
HNO_3 (nitric)	1.42	70.3	42.2

*All acids c. p.

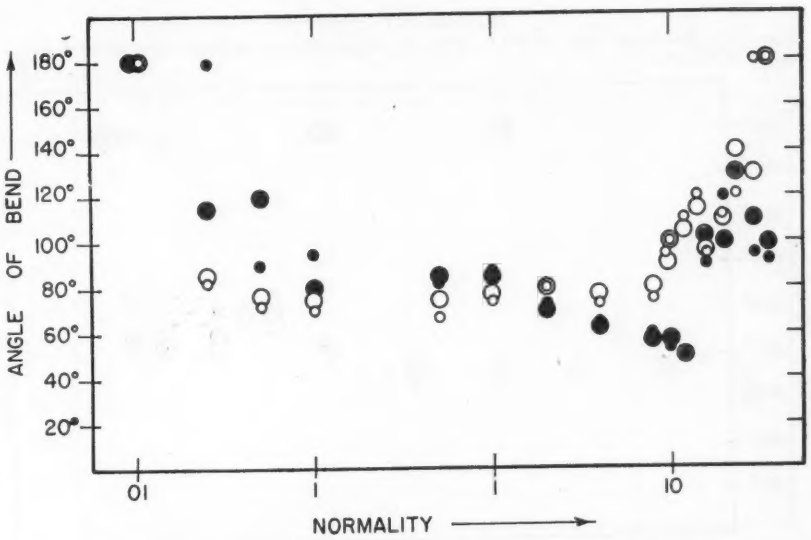

Figure 2. — Sulfuric Acid (H_2SO_4): effect of concentration on Hydrogen Embrittlement Temperature = 65°C (150°F) Pickling Time = 15 min. O = Stainless Steel ● = Mild Steel. * *

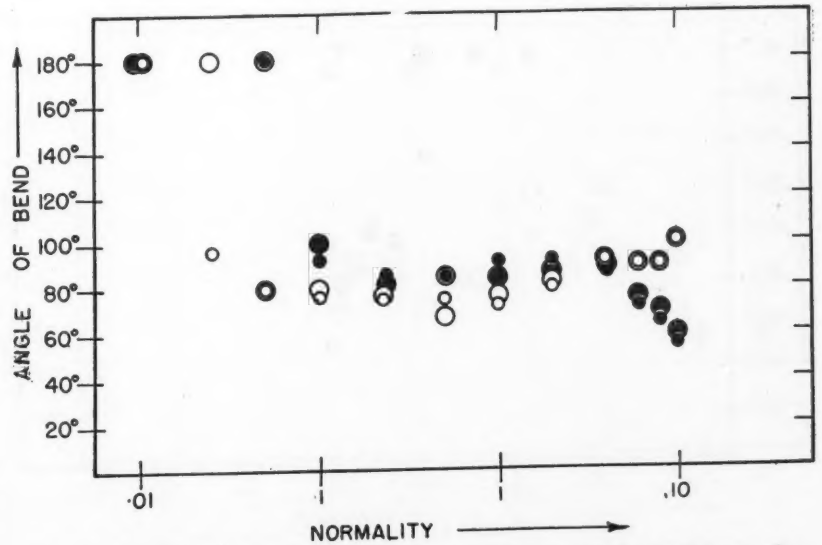

Figure 3. — Hydrochloric Acid (HCL): effect of concentration on hydrogen embrittlement. Conditions of Figure 2. * * * * *

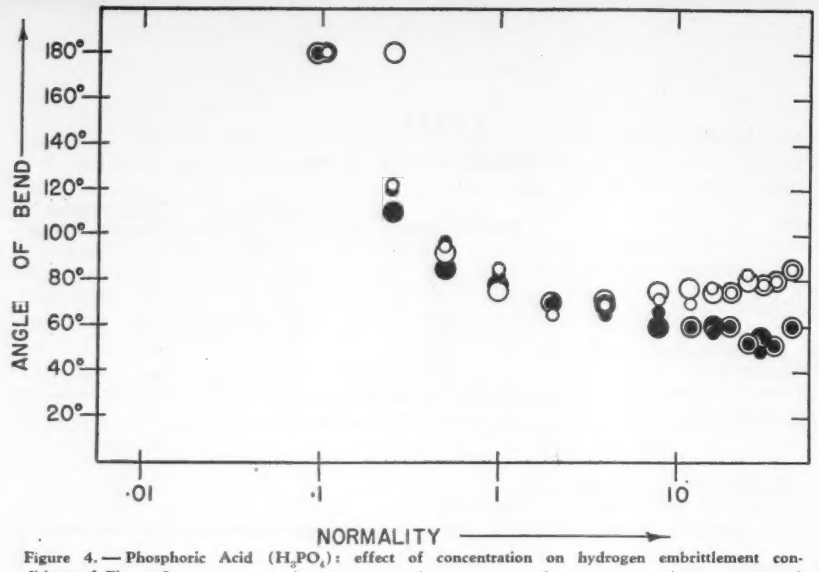

Figure 4. — Phosphoric Acid (H_3PO_4): effect of concentration on hydrogen embrittlement conditions of Figure 2. * * * * *

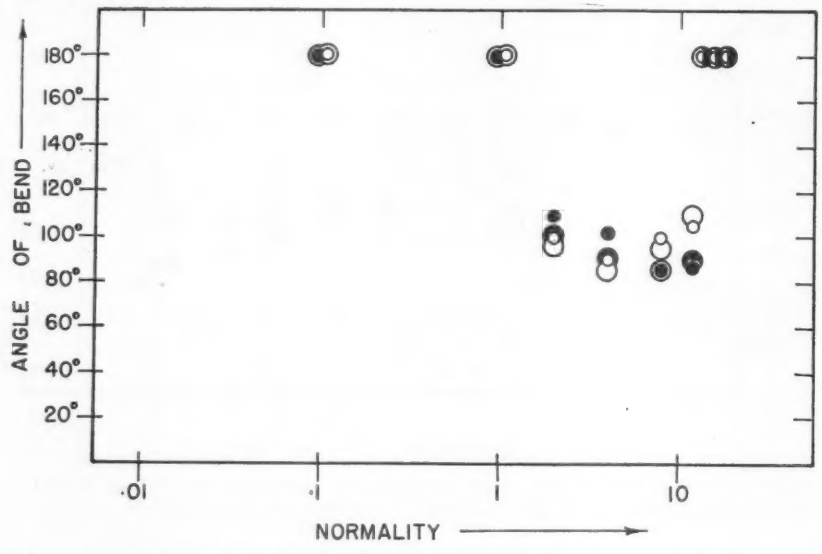

Figure 5. — Acetic Acid (CH_3COOH): effect of concentration of hydrogen embrittlement. Conditions of Figure 2. * * * * *

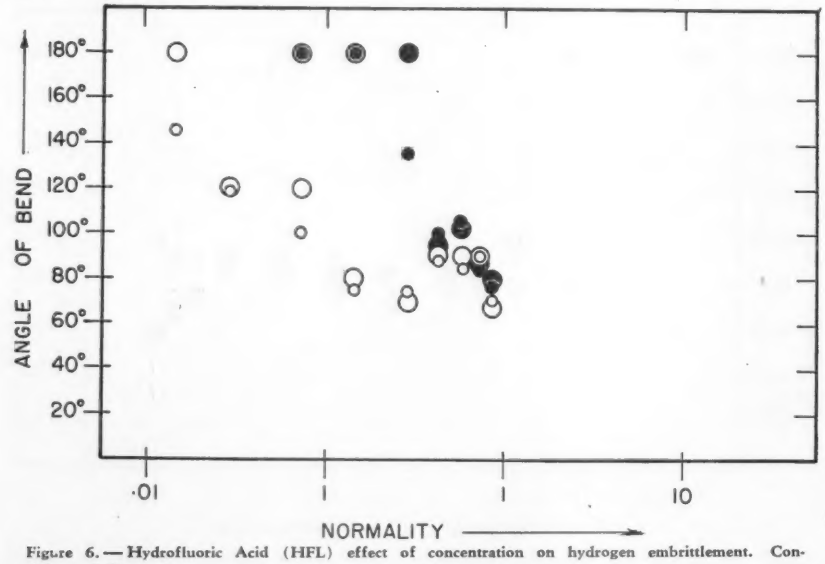

Figure 6. — Hydrofluoric Acid (HFL) effect of concentration on hydrogen embrittlement. Conditions of Figure 2. * * * * *

is significant that all bend values proceed to a minimum in the range of 60 to 80 degrees. Very concentrated acetic acid, whose dissociation is virtually nil, injures neither steel.

* * *

HYDROFLUORIC acid, which is highly ionized, causes defection comparable to H_2SO_4 and HCl so far as the stainless steel is concerned, but its effect is less on mild steel. This is the first important divergence of the two behaviors; and it conforms with the known usefulness of mild steel in handling fluoride solutions, and the known susceptibility of chromium-containing steels to the halides — specifically, chlorine, bromine, and, here, fluorine.

* * *

AS for nitric acid, HNO_3, no embrittlement of stainless steel could be detected under any conditions of concentration or temperature, and several grades other than 440-C were studied. Mild steel did show a slight indication of brittleness, particularly in 2-normal acid. Also HNO_3-HF mixtures were studied, since they are commercially useful in pickling stainless steel. No embrittlement could be detected for any of the stainless steels, even when the HF/HNO_3 ratio was increased to 50% (by volumes).

Effect of Temperature

AS with electrolytic pickling, increasing the temperature of the acid pickling bath increases the embrittlement for a given pickling period. With acid pickling, of course, more hydrogen is produced per unit of time in hot acid: but the fact that the same effect on embrittlement is observed with cathodic pickling at fixed current density means that the acid attack is not the controlling factor. Instead, the rate of transfer of H atoms into the metal is obviously increased importantly with increasing temperature. Figure 7 shows three series of tests run in HCl of varying concentration and temperature. Similarly, Figure 8 shows the behavior of embrittlement over a range of temperature, keeping concentration constant at 1-normal H_2SO_4; and Figure 9 shows the same for 4-normal CH_3COOH.

NOTE that for each test condition a minimum temperature is finally reached below which embrittlement is not measurable by the present test. Also note that this critical temperature is considerably higher for the weaker acid. This does not mean that embrittlement does not occur at lower temperatures. A smaller bend radius would perhaps detect embrittlement in this test; also, the present radius would detect embrittlement in a test of longer duration than the specified 15 minutes. But embrittlement is greatly decreased at lower temperatures.

Effect of "Promoters" In The Pickling Solution*

Sulfur

IN a previous paper in this Journal (May 1947), one will recall, sulfide ion caused a marked increase in embrittlement when added to a cathodic pickling solution. We shall now compare the behavior of such additions in straight acid pickling (uninhibited), using wire from Coil III listed in Table II.

* * *

WHEN hydrogen sulfide (H_2S) was bubbled through 10% H_2SO_4 at several temperatures, the pickled wire behaved as shown in Figure 10. The upper curve is the standard for the raw acid. The lower curve represents the tests with sulfide added; and the shaded area measures the added defection caused by the presence of the sulfide ion.

* * *

SINCE an increase in embrittlement causing a drop in bend value of 50% can be extremely significant in fabricating wire, attention should be called to the fact that the active impurity here is sulfur — an element known as a "promoter" of hydrogen embrittlement (this Journal, May 1947) — and that sulfur can enter the bath through other means than H_2S. For example, plant problems with hydrogen are known to increase with the age of pickling liquor. Such problems might therefore be traced to a sulfur pickup in the bath, leached from the steel itself over extended periods of time, particu-

*See Ref. 2.

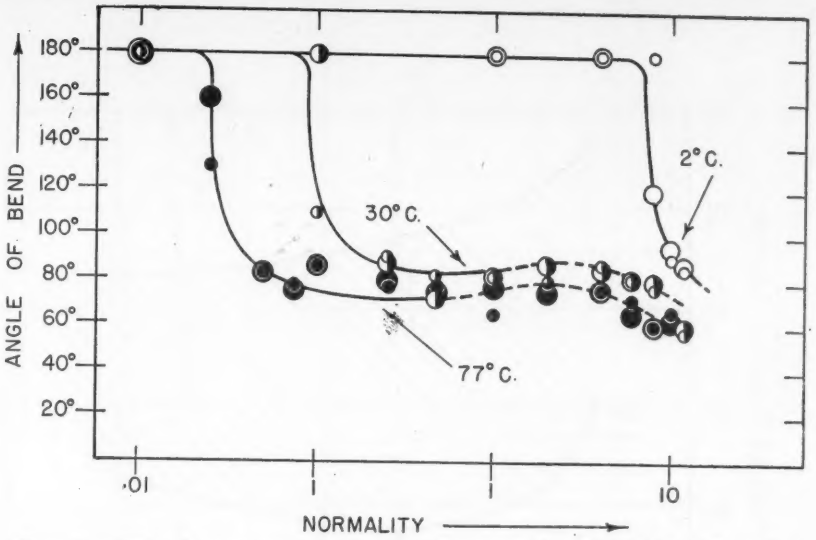

Figure 7. — Effect of temperature on hydrogen embrittlement. Acid = HCL. Pickling Time = 15 mins. Specimen = Mild Steel. * * * *

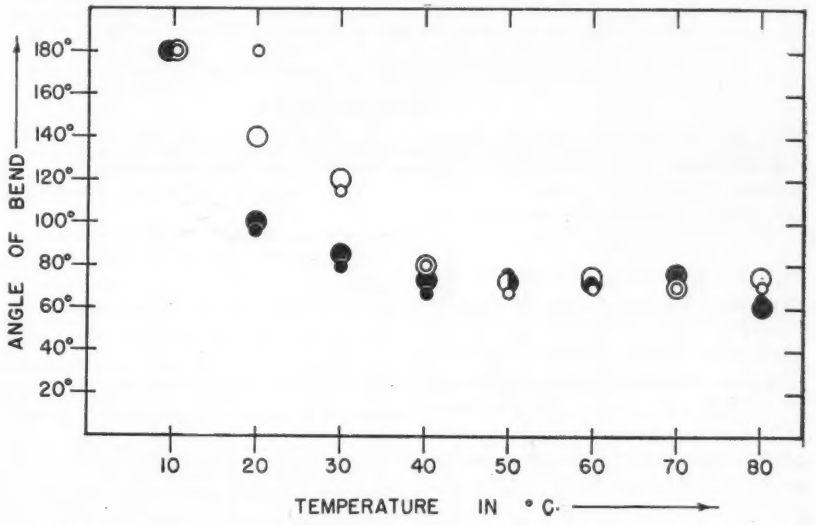

Figure 8. — Effect of temperature on hydrogen embrittlement. Acid = H_2SO_4. Pickling Time = 15 mins. Specimen: O = Stainless Steel. ● = Mild Steel. * * *

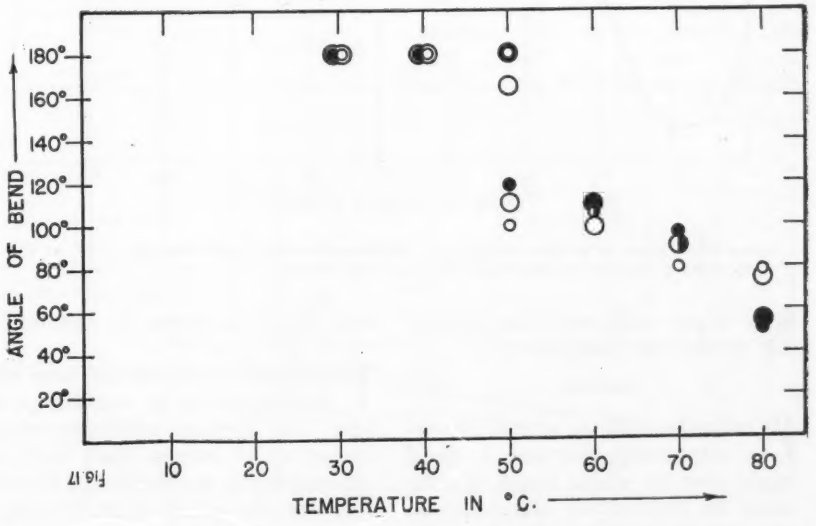

Figure 9. — Same as Figure 8. using 4-normal Acetic Acid (CH_3COOH). * *

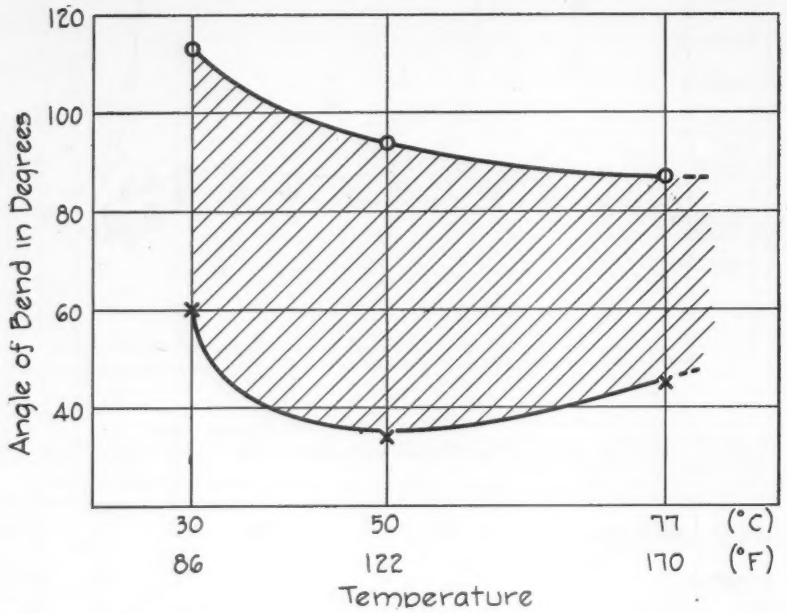

Figure 10. — Effect of Sulfide Ion on Hydrogen Embrittlement during Acid Pickling. Acid = 10% H_2SO_4 Pickling Time = 15 mins. O = Untreated Acid. X = Acid saturated with H_2S. * * *

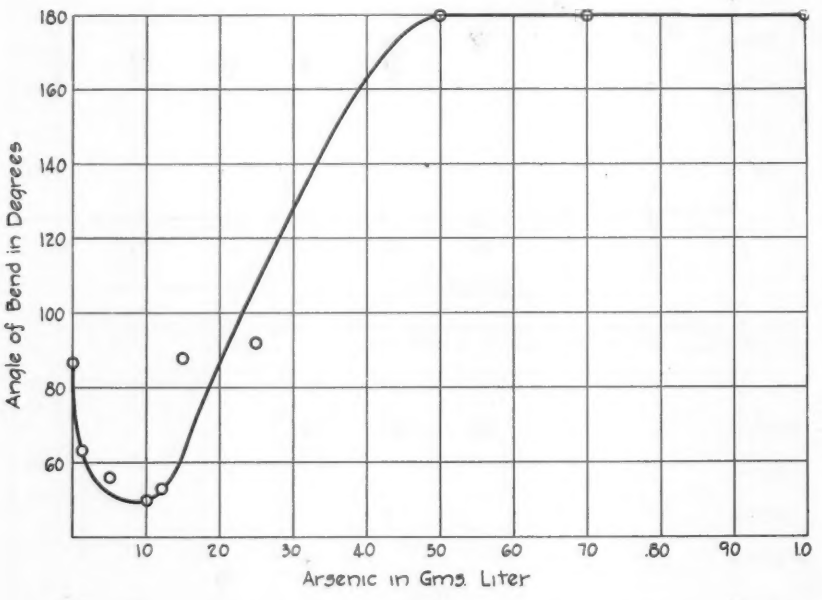

Figure 11. — Effect of Arsenic on Hydrogen Embrittlement during Acid Pickling. Acid = 10% H_2SO_4 Pickling Time = 15 mins. Temperature = 77°C 170°F). * * *

larly where sulfurous free-machining grades are concerned.

Arsenic

IN cathodic pickling, arsenic caused an astonishing decrease in bend angle over its whole range of solubility in 10% H_2SO_4 **(loc. cit.)**. In straight acid pickling, however, an even more remarkable effect is now found, as shown in Figure 11.

* * *

THUS, early additions increase embrittlement as in cathodic pickling; but further additions cause the curve to **reverse** itself until at concentrations greater than 0.5 gms./liter (approximately 1 oz./10 gals.), arsenic actually acts as an inhibitor of hydrogen embrittlement.

THIS immediately calls to mind the long history of arsenic as an inhibitor in acid pickling[3], chosen on the basis of decreased metal attack. Aside from undesirable properties from the plant and operator's standpoint, arsenic is truly an inhibitor of both metal attack and hydrogen embrittlement—when used in the proper proportions. But one's curiosity might be aroused regarding puzzling troubles that were possibly encountered in plants unknowingly using arsenic in its range as a "promoter" of hydrogen absorption.

"Inhibitors" in Acid Pickling (Stainless Steel)

IN view of these effects of arsenic and sulfur, and the issue developed in a preceding paper regarding commercial pickling inhibitors, there immediately arises a prime question: **What is the actual effect of commercial pickling inhibitors on hydrogen embrittlement following from straight acid pickling?** In cathodic pickling, it will be recalled, one of the two reagents tested actually **increased** embrittlement.

* * *

CONSEQUENTLY, a representative group of commercial inhibitors for sulfuric acid pickling was assembled, comprising popularly known products.

* * *

ALTHOUGH these reagents were designed primarily for mild or low-alloy steel, no reason has ever been expressed or implied for believing that the inhibitor does not behave similarly with stainless steel; and most stainless steel plants in the writers' experience select the inhibitor on the basis of the acid type, not the steel type.

* * *

ACCORDINGLY, for the preliminary tests now to be discussed, the standard Coil III stainless steel wire will be considered solely, because its response to hydrogen absorption has been so well established by previous work. Nevertheless, we must keep in mind that the data refer specifically to the conditions of the test, and that the relationships using carbon steel are

reserved for separate consideration. It is sufficient as a preliminary contribution to reveal the fact of the surprising behavior of commercial inhibitors when applied to laboratory testing using standardized stainless steel specimens. All matters concerning practical implications, and extension and completion of the new aspects disclosed by the present tests, belong to a subsequent stage of the work.

Reagent I

IN all following charts, the "blank" value on the ordinate (at zero addition of inhibitor) represents a 15-minute pickling test at 77°C (170°F.) and in 10% H_2SO_4, unless otherwise specified. The progress of the curve then traces the bend value for duplicate pickling tests in which the **only change** in pickling condition is the addition of the indicated quantity of the reagent.

* * *

ONE of the most popular of the commercial pickling inhibitors for use in sulfuric acid, designated for present purposes as Reagent I, served for the first tests. On Figure 12 the astonishing results are revealed. The addition of Reagent I to the sulfuric acid pickling solution **greatly increases embrittlement beyond that caused by pickling in raw acid,** as indicated by the downsweeping curve. These results are rendered even more remarkable by the fact that the metal attack is decreased virtually to zero.

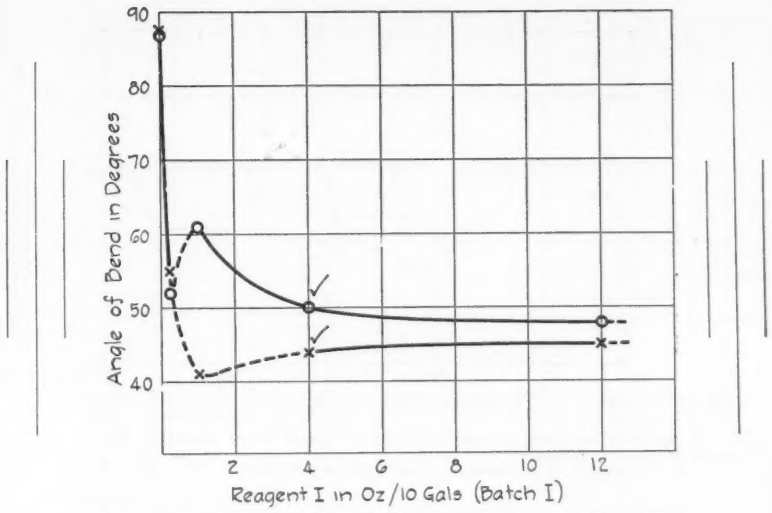

Figure 12. — Effect of Pickling Inhibitor Reagent I on Hydrogen Embrittlement.
X = Polished Specimens. O = Unpolished Specimens. √ = Proprietary addition.

* * *

BECAUSE of these unusual results, special efforts were made to verify them. First, a series of tests was run using specimens as **oxidized** — that is, uncleaned before pickling to simulate mill conditions. The results were substantially the same, the bend values lying along the slightly higher curve in Figure 12. One would expect this from impedance of the hydrogen-producing reaction by the scale layer. The arrows on this and following graphs, incidentally, indicate the common proprietary addition.

* * *

TO find whether such unexpected results are a characteristic of the acid, a series of tests was run in 1:1 HCl under similar conditions. The data in Figure 13 are virtually identical with those for H_2SO_4, in keeping with the conclusion earlier drawn respecting pickling in the two acids. (See previous Figures 2 and 3.)

* * *

AS a further check, a new batch (Batch II) of Reagent I was obtained, just in case Batch I had deteriorated or become contaminated. But its behavior in H_2SO_4

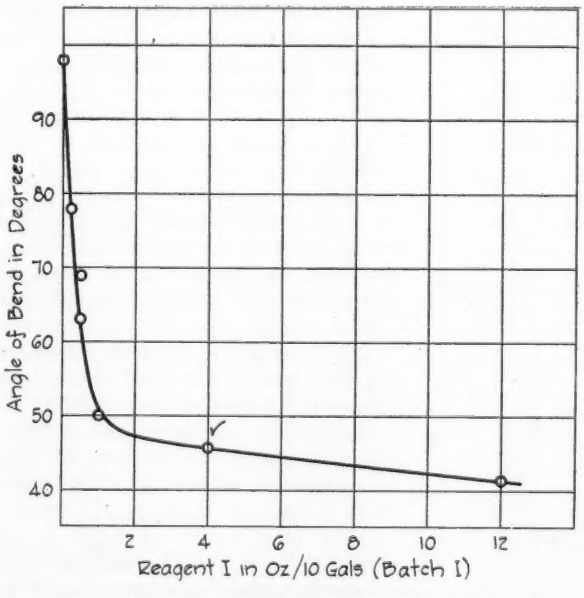

Figure 13. — Figure repeated using 1:1 Hydrochloric Acid (HCL)

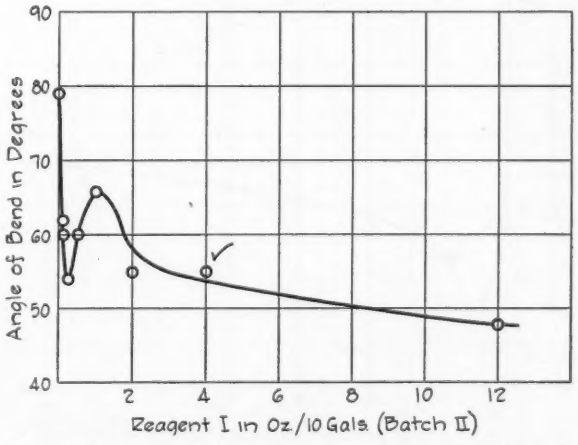

Figure 14. — Figure 12 repeated with a new batch of Reagent I

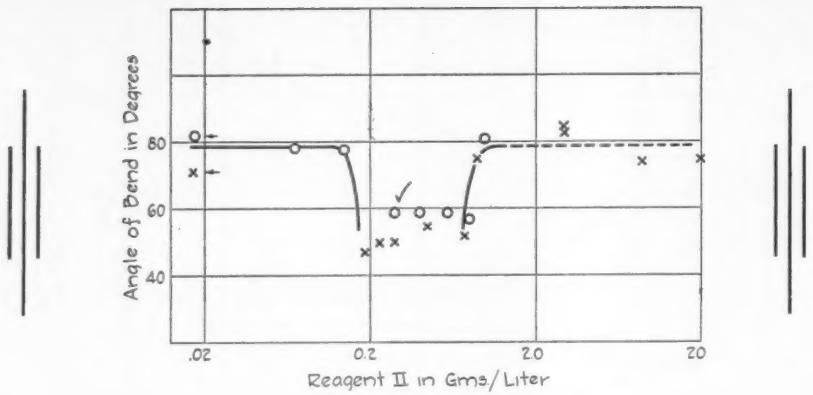

Figure 15. — Effect of Pickling Inhibitor Reagent II on Hydrogen Embrittlement. Conditions of Figure 11.
O = Series 1. X = Series 2. √ = Proprietary addition. * * *

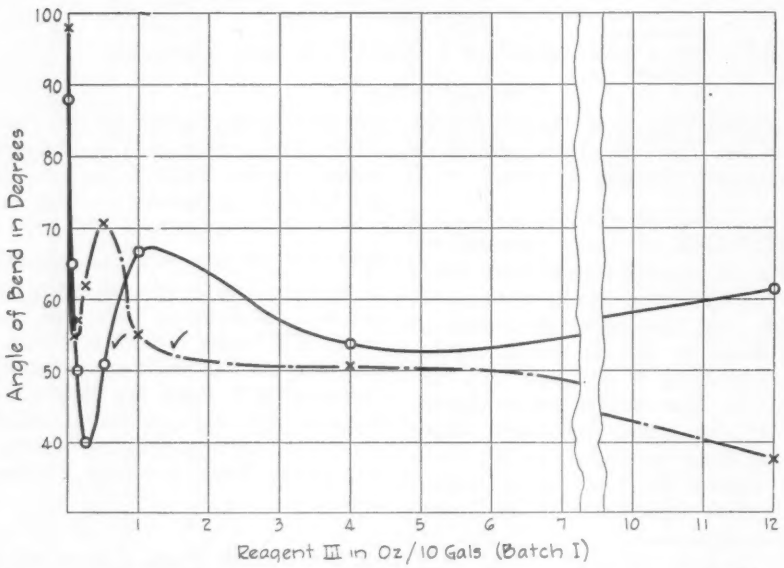

Figure 16. — Effect of Pickling Inhibitor Reagent III on Hydrogen Embrittlement. Conditions of Figure 11. O = 10% H_2SO_4. X = 1:1 HCL. √ = Proprietary additions. * * *

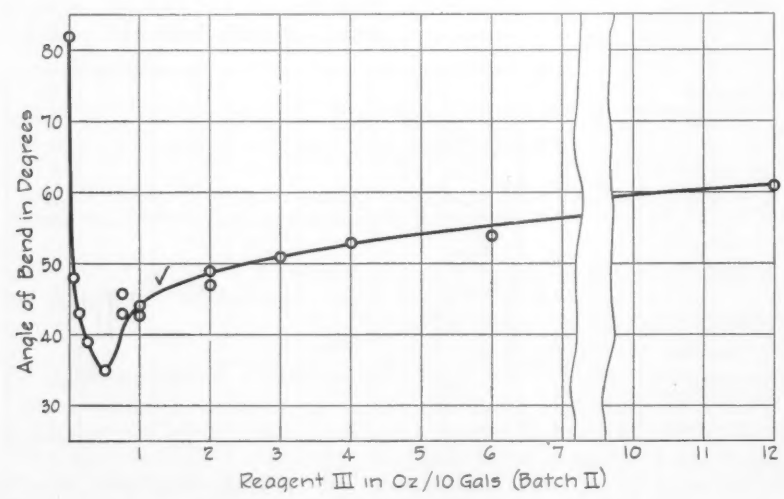

Figure 17. — Figure 16 repeated with a new batch of Reagent III in Sulfuric Acid. * * *

(see Figure 14) reproduced that of Batch I even to the indication of a minor reversion in the embrittlement loop near 1 oz./10 gals.

* * *

CERTAINLY these are surprising data. They reveal a most interesting instance of an "obvious" conclusion being the wrong conclusion. Because hydrogen is known to be produced by chemical attack, and because inhibitors are known to decrease greatly the metal attack, the "obvious" conclusion has been popularly drawn that pickling inhibitors coincidentally inhibit hydrogen absorption. Now in the face of a contrary fact, little wonder it is that embrittlement and possibly blistering and poor adherence — defects commonly caused by hydrogen — have occasionally puzzled operators by persisting in plants in spite of the addition of an inhibitor. Indeed, the slow recognition of hydrogen as the cause of these and other troubles may very likely have followed from the belief that the gas was not actively present in inhibited baths.

* * *

OBVIOUSLY, we are dealing with an unique situation in which the control of hydrogen absorption is vested in the surface concentration of invisible hydrogen atoms — not molecules or visible bubbles — and this concentration is strongly aggravated by the presence of the inhibitor, decreased metal attack notwithstanding. The **removal** of hydrogen as gaseous molecules, upon which continuing metal attack depends, is greatly impeded by the inhibitor; and it is this relationship which has popularly misled the observer. Removal of the reaction product by diffusion into the metal has never been considered. The present work discloses this role with respect to surface atomic hydrogen, which is the only form of hydrogen that will dissolve in the metal; and the amount of solution, of course, undoubtedly increases directly with the surface concentration. The truth of this statement is indicated in the fact that molecular hydrogen is stored within steel tanks at high pressures and for long periods of time without either loss of the gas or embrittlement of the tank.

Reagent II

TESTS with a second popular commercial inhibitor, Reagent II, yielded results of the same kind, but differing in degree. In spite of a greatly decreased metal attack, embrittlement continued to be as severe as in raw acid. Humorously, in the very range of the proprietary addition recommended by the manufacturer, and only in that range, the embrittlement suddenly becomes worse! (See Fig. 15.)

* * *

IN all these tests, it will be noted that a broad range of addition is studied — from traces to saturation, or at least to a pronounced excess.

Reagent III

ANOTHER popular commercial inhibitor, Reagent III, developed a violent initial drop in bend angle characteristic of Reagent I. Additions much less than the proprietary imediately reduced the bend angle to a value 40° or 50° less than that resulting from pickling in raw acid. (See Figure 16.) The peculiar reversal found with Reagent I also showed itself in these data, the curve falling to 40° at half the proprietary adidtion and rising to 65° somewhat past the proprietary, then dropping once again with excessive additions.

* * *

A duplicate series was run in 1:1 HCl, and a similar curve was obtained (see Figure 16), differing only in the position of the reversed portion.

* * *

AS with Reagent I, a fresh lot was obtained (Batch II) from the manufacturer. Its behavior was essentially the same as Batch I, except that excesses above the proprietary did not cause a second reversal toward lower values. The curve instead continues up (see Figure 17), although a twelve-fold excess still renders embrittlement which is much worse than that from pickling in raw acid.

Reagents IV, V, and VI

REAGENT IV neither increased nor decreased embrittlement —

(*Please turn to page* 792)

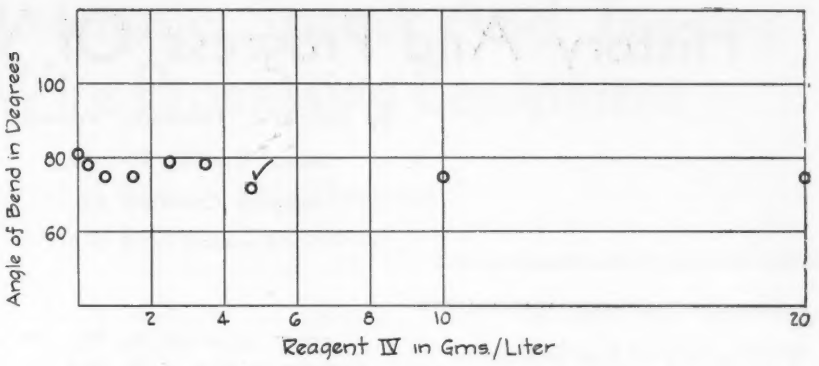

Figure 18. — Effect of Pickling Inhibitor Reagent IV on Hydrogen Embrittlement. Conditions of Figure 11. * * *

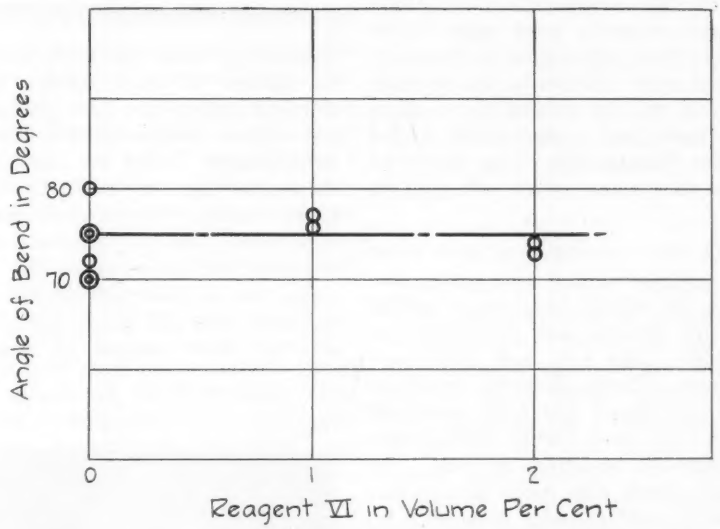

Figure 19. — Effect of wetting agent Reagent VI on Hydrogen Embrittlement. Conditions of Figure 11. * * * *

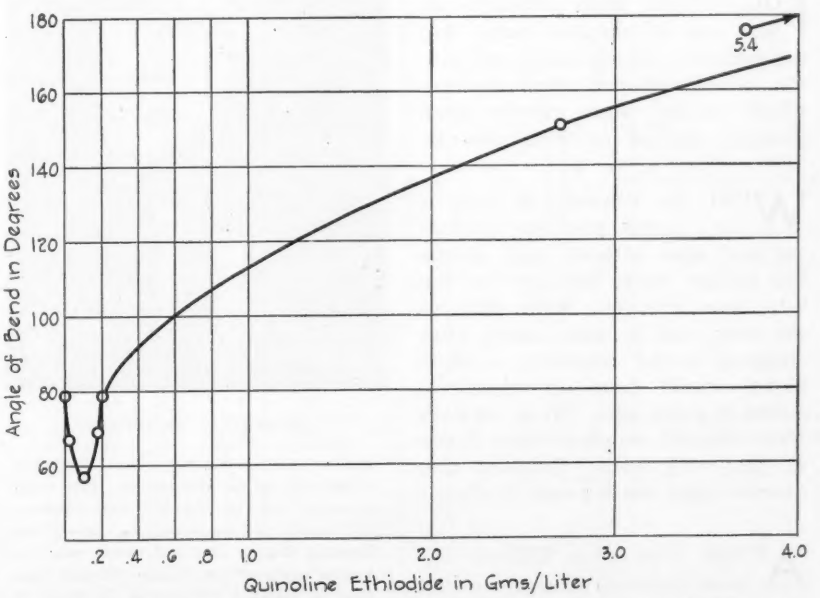

Figure 20. — Effect of Quinoline Ethiodide on Hydrogen Embrittlement. Conditions of Figure 11.

History And Progress Of Wire Coatings

By Harold L. Trembicki, Manager
Metal Coating Division
Magnus Chemical Co.
Garwood, N. J.

A paper presented at the San Francisco Meeting of the Wire Association, June 4th, 1948.

THE history of lime substitutes in the wire drawing industry goes back many years, but it was only twenty-five years ago when really serious attempts were made to replace lime with other coatings on bright wire and special finish wire, and to cut the baking time. Most of these first experiments ended rather disastrously — in scratched wire with a new silver dollar finish.

* * *

THE first experiments were made with tri-sodium phosphate solutions to which later were added various alkalies such as sodium hydroxide, soda ash, and other carbonates. These different combinations produced not only scratched wire, but also highly hydroscopic conditions, resulting in rust. Attempts were also made to use this type of coating under lime, with no better results.

* * *

FOLLOWING these experiments, the use of silicates came into the picture — mostly combined with the above-mentioned alkali mixtures which, in fact, were merely metal cleaners applied as wire coatings.

* * *

WITH the silicates, at first it was found possible to draw rod and wire without lime, mostly low carbon stock, but here we ran into more trouble. After drawing the wire, and in many cases, after shipping to the customer, a white bloom would show up which resulted in rusty wire. Many carloads were rejected, causing heavy losses to the wire mills. Silicates also caused rapid cutting out of dies.

* * *

AFTER these first failures, the wire industry became rather sceptical about the question of lime substitutes, and the work had to be started all over again. Some dropped out of the fight gradually, but others continued with further experiments. I had an unshakable conviction that wire could be drawn better without the use of lime. I met with a lot of opposition from some of the veterans in the wire mills, but a good part of the wire industry was still interested in improving their method of drawing wire. This became even more true with the development, in recent years, of the high-speed wire drawing machines.

* * *

HAROLD L. TREMBICKI

Harold Trembicki has had a broad experience in new coatings for wire drawing. After being connected with the Crucible Steel Company of America for ten years he entered the Chemical field in 1922 and several years ago became associated with Magnus Chemical Company of Garwood, New Jersey, in charge of the Metal Coating Division. * * *

THE next development in coating compounds was to use a carrying and binding agent which would seal the coating more readily on the surface of the metal. The same combinations were used, only with less sodium hydroxide and more silicates. To these were first added different soaps, mostly tallow soaps, which did not work out very well.

* * *

ROSIN soap then came along, and that combination began to show the first promising results. The combination of alkalies, silicates and rosin would not successfully draw wire without lime, was hard on the dies, and permitted only one or two passes without re-coating, and even this was mostly on low carbon stock. The rosin compounds, however, were used for quite a number of years as a coating under lime, principally as neutralizers.

* * *

By this time, it was found definitely that strong alkalies, silicates and rosin soaps would not work successfully as a rod and wire coating to be used without lime, and on the new high-speed machines would not give production results.

* * *

SOME work has also been done with phosphate compounds, but these cannot be considered as a wire coating. They only prepare the surface of the metal for subsequent lime coating and lubricant pickup. It is just another undercoat for lime.

(*Please turn to page* 794)

Drives For Automatic Speed And Tension Control In Wire Processing Equipment

PART II

By N. J. Ranney, Chief Engineer
Wean Equipment Corporation
Cleveland, Ohio

Part II, Mechanical and Tydraulic Drives, together with the conclusions reached, will follow here. Part I was published in August, 1948.

PART II — MECHANICAL DRIVES

Mechanical Variable Speed Transmission

THERE are a number of varieties of mechanical variable speed transmissions on the market, the most common of which is the split pulley type. In this unit there are two parallel shafts, on each of which is mounted a cone-faced split pulley. The two pulleys are connected by a V-belt, and the ratio between the two parallel shafts can be varied by changing the pitch diameter of the split pulleys. This change in ratio is accomplished mechanically while the unit is running, and standard units are usually equipped with a handwheel and screw for making this adjustment.

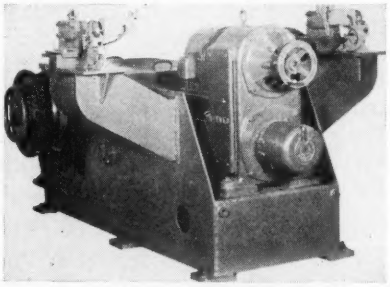

Fig. 11. — Two-Block Traversing Coiler. * *

* * *

THE most familiar application of the mechanical variable speed transmission is in connection with machinery such as machine tools where it is desired to be able to operate at any set speed over a range of about 4:1. The variable speed transmission is connected between the source of power, usually an A-C motor, and the machine to be regulated.

* * *

THE two block traversing coiler illustrated in Figure 11 is a typical example of such an application. The variable speed transmission shown is a packaged unit combining electric motor, speed changing unit, and reduction gears in a common assembly. Braking is provided by a magnetic brake mounted on the transmission. The speed is set manually by the handwheel and remains constant.

* * *

BY providing for automatic speed adjustment through either electrical, mechanical, or hydraulic means, the mechanical variable speed transmission can also be applied to give automatic and continuous speed or tension control in connection with many wire mill operations.

Wire Flattening Mill Application of Mechanical Variable Speed Transmission

ONE interesting application of this type is on a 3-stand tandem wire flattening mill for flattening copper wire. The requirements call for a speed range of from 400 to 1600 f.p.m. on the mills, and accurate speed control between stands.

* * *

FIGURE 12 shows schematically the application of the mechanical variable speed drive to the mill. The variable speed drive unit for the first stand serves as the master drive unit for the entire mill. It is driven by an A-C motor, and a speed adjustment of 4:1, remotely controlled, is provided. Chain and sprocket drives are provided from the output shaft of the master drive

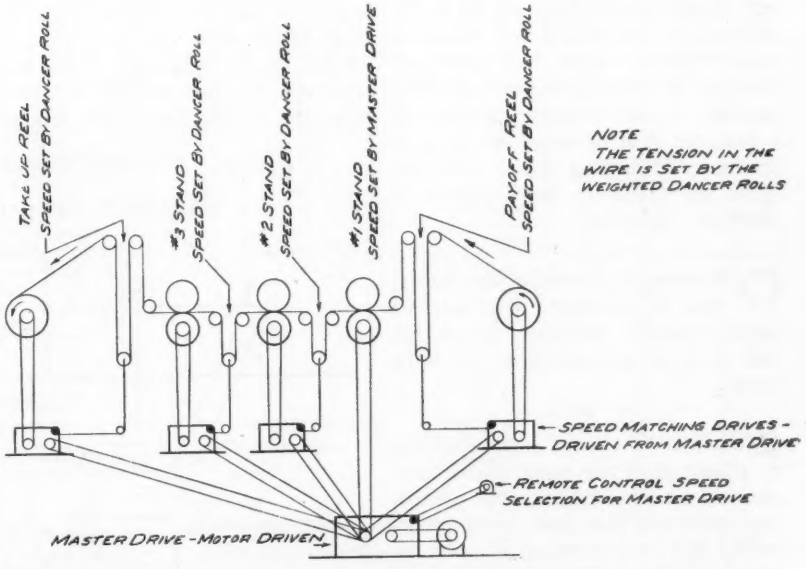
TAKE UP REEL
SPEED SET BY DANCER ROLL
#3 STAND
SPEED SET BY DANCER ROLL
#2 STAND
SPEED SET BY DANCER ROLL
#1 STAND
SPEED SET BY MASTER DRIVE
PAYOFF REEL
SPEED SET BY DANCER ROLL
NOTE
THE TENSION IN THE WIRE IS SET BY THE WEIGHTED DANCER ROLLS
SPEED MATCHING DRIVES - DRIVEN FROM MASTER DRIVE
REMOTE CONTROL SPEED SELECTION FOR MASTER DRIVE
MASTER DRIVE - MOTOR DRIVEN

Fig. 12. — Use of mechanical variable speed transmission for speed control of 3-strand tandem wire flattening mill. * * * * * *

unit to the No. 1 stand, and to intermediate variable speed drive units provided for the two succeeding mill stands and for the payoff and takeup reels.

* * *

INITIAL tension is put in the wire by a weighted compensator roll which operates in a loop between the payoff reel and the No. 1 stand and controls the output speed of the variable speed transmission driving the payoff reel.

* * *

THE speeds of the second and third mill stands and the takeup reel are also controlled by the compensator rolls which adjust the speed of their respective variable speed transmissions.

* * *

THIS arrangement of mechanical speed control results in accurate synchronizing of the speeds of the No. 2 and No. 3 mill stands with the speed of the flattened wire. The tension in the wire between the payoff reel and the No. 1 stand, between the stands, and between the last stand and the takeup reel is set by the weighted compensator rolls.

Coiling Application of Mechanical Variable Speed Transmission — Speed Control

ONE problem which frequently presents itself is that of controlling the speed of a reel as a coil builds up in diameter so as to maintain a constant lineal speed of travel for the wire. For example, it might be desired to pull the wire through a heat treating furnace at a uniform rate of speed or to synchronize the coiling speed with the speed of the wire as it leaves a previous operation.

* * *

ONE means of solving this problem is through the use of speed control, utilizing a contact roll to give an indication of wire speed.

* * *

FIGURE 13 shows a typical application of the mechanical variable speed transmission to control the speed of the reel as the coil builds up, maintaining a uniform speed of wire travel. In this case, the reel is driven from the output shaft of a variable speed transmission, the input shaft of which is driven from a constant speed A-C motor. The speed of the variable speed transmission is continuously controlled from a small differential unit. One input shaft of the differential is driven by the contact roll which measures the speed of wire travel. The other input shaft of the differential is driven from the A-C drive motor through a control variable speed transmission. The output speed of this transmission is set manually for the desired speed of wire travel.

* * *

SO long as both input shafts of the differential are driven at the same speed, the output shaft remains stationary. However, as the coil diameter builds up, the speed of the wire travel tends to increase, and this increase in speed is reflected by the contact roll and the corresponding input shaft of the differential. The output shaft then starts to rotate, slowing down the main variable speed transmission until the speed of wire travel is in accordance with the control setting. This speed correction is automatic and continuous. The control variable speed transmission must have a speed range equal to the lineal speed range desired through the processing equipment, and the main variable speed transmission must have additional range equal to the ratio of the maximum coil diameter to the minimum coil diameter. For example, if the speed through the processisng equipment was 100 to 200 f.p.m. and the wire was wound into a coil 8 inches I.D. and 16 inches O.D., a 2:1 speed range would be required on the control transmission, and a 4:1 speed range on the main transmission.

Coiling Application of Mechanical Variable Speed Transmission — Tension Control

IN order to maintain constant tension in the wire being coiled, the torque must be increased and the r.p.m. decreased as the coil builds up in diameter. This is accomplished by a constant horsepower drive.

* * *

IF we have a means of mechanically measuring the horsepower delivered by the drive, and automatically adjust the speed of the reel to maintain this horepower at a set value, constant tension in the wire will be obtained.

* * *

FIGURE 14 illustrates a drive which accomplishes this by using belt slip or creep as a measure of horsepower. In a belt drive, there is a speed difference between the driving and the driven pulleys due to the contraction in the belt as it passes from the high tension on the driving side to the low tension on the slack side. As long as static frictional contact is maintained between the belt and the pulley, the speed difference is proportional to the power transmitted.

* * *

IN the arrangement shown in Figure 14, the input shaft of a vari-

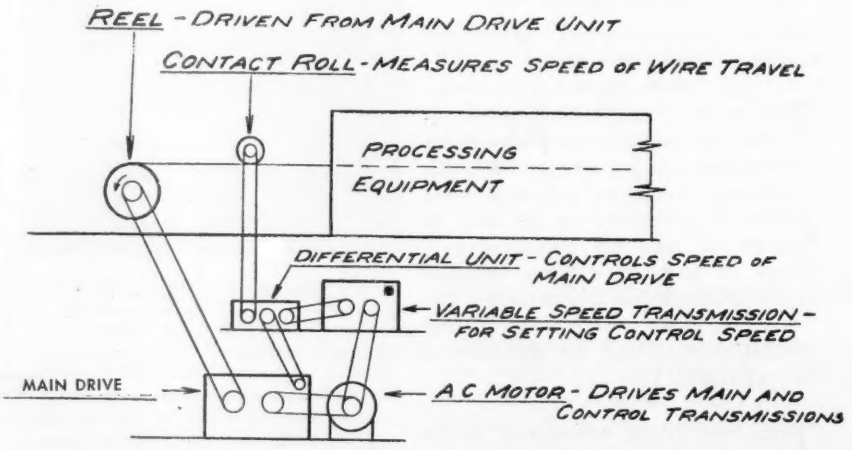
REEL - DRIVEN FROM MAIN DRIVE UNIT
CONTACT ROLL - MEASURES SPEED OF WIRE TRAVEL
PROCESSING EQUIPMENT
DIFFERENTIAL UNIT - CONTROLS SPEED OF MAIN DRIVE
VARIABLE SPEED TRANSMISSION - FOR SETTING CONTROL SPEED
MAIN DRIVE
A.C. MOTOR - DRIVES MAIN AND CONTROL TRANSMISSIONS

Fig. 13. — Use of mechanical variable speed transmission for speed control of coiling operation.

able speed transmission is driven from a motor by a belt drive of the type described. The reel is driven from the output shaft of the transmission.

* * *

A differential control unit is used to measure the speed difference between the motor pulley and the pulley on the input shaft of the transmission. One input shaft of the differential is connected to the motor shaft, and the other input shaft of the differential is connected to the input shaft of the transmission. With the two input shafts of the differential rotating at the same speed and in the proper direction, the output shaft remains stationary. Where there is a difference in speed between the two input shafts due to the difference in speed between the motor and transmission pulleys, the output shaft will rotate at one-half the difference between the speeds. With the output shaft connected to the speed adjustment of the variable speed transmission, as shown in Figure 14, the speed of the reel is automatically regulated.

* * *

IN operation, as the coil builds up, there is a tendency for the load to increase. This is reflected in an increase in the speed difference between the driving and driven pulleys, causing the differential to operate to slow down the reel. This is a continuous and automatic process as the coil builds up, resulting in constant tension in the wire. The amount of tension can be adjusted by adjusting the amount of weight on the tension idler.

Cut-to-length Control by Mechanical Variable Speed Transmission

BY combining the variable speed transmission with a differential type gear reducer, it is possible to obtain either infinite speed range, or micrometer adjustment over a small range. This arrangement can be used for extremely accurate matching of speeds or for accurate control of wire feed.

* * *

FOR example, a control arrangement of this type can be used in connection with cut-to-length equipment, where rotary knives rotate at a fixed rate of speed, and the length of cut is controlled by the speed of the feed rolls.

* * *

FIGURE 15 illustrates an application of this type schematically. The differential unit can be a gear reducer of the spur gear, planetary, differential, or heliocentric type mounted by the input and output shafts so that the housing is free to rotate. One shaft of the differential is connected to the input shaft of the variable speed transmission, and the other shaft of the differential unit is connected to the output shaft of the variable speed transmission. The feed rolls are driven from the rotating housing of the differential.

IF, for example, the variable speed transmission has an output speed range of 100 to 500 r.p.m. and the differential has a ratio of 39:1 then the entire speed adjustment range of the transmission, amounting to 400 r.p.m., will control a speed change of 10 r.p.m. from the differential unit. As a result, extreme accuracy and fineness of adjustment is obtained.

* * *

Friction Slip Clutch

PERHAPS the oldest means of mechanical speed control is the friction slip clutch. The chief application has been in connection with coiling equipment, to slow down the spool or a block as the coil builds up and thus maintain a uniform lineal speed for the wire. The slippage results from the tension set up in the wire as the coil diameter increases. The clutch design has varied from small friction discs with adjustable spring loading for fine wire spoolers to rope clutches used on heavy duty take-up frames. One of the more modern clutch designs has a rubber diaphram and the clutch pressure is controlled by adjustable air pressure.

* * *

THERE are several disadvantages to be considered in the application of the friction slip clutch. First, since it is a constant torque device, the amount of tension required to produce slippage decreases as the

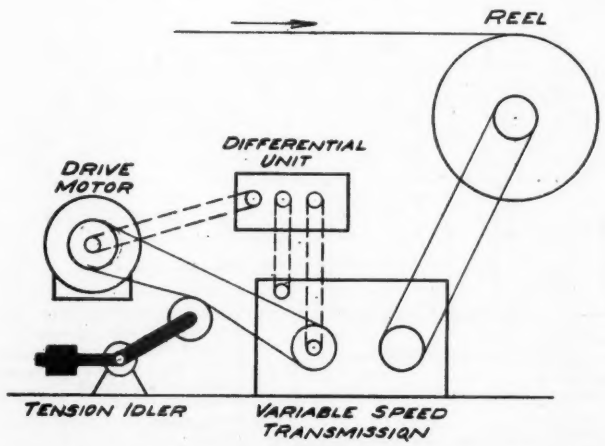

Fig. 14. — Use of mechanical variable speed transmission for control of tension control of coiling operation. * * *

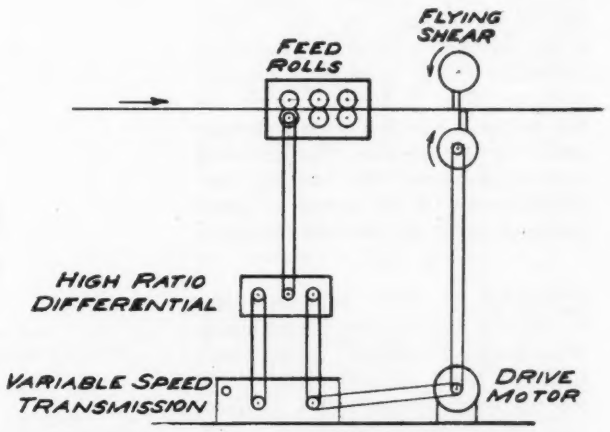

Fig. 15. — Use of mechanical variable speed transmission in accurate control of wire feed in cut-to-length unit. * *

coil diameter increases. Thus, while speed control is obtained, the amount of wire tension continually varies. Second, the torque required for slippage is not always uniform, and jerky operation sometimes results. This is especially true when starting, stopping, or inching. Third, the power required for producing slippage is wasted, and results in heat. Fourth, the speed range is limited to about 3 to 1. Finally, considerable maintenance is required.

* * *

THE friction slip clutch has the compensating advantages of being relatively simple and inexpensive, and in many cases where the horsepowers involved are low and the buildup is small, it provides a satisfactory solution to the problem.

PART III — HYDRAULIC DRIVES

ALTHOUGH the use of hydraulic speed and tension control in connection with wire mill equipment is relatively new, it lends itself into several applications on which pioneering has been done with promising results. A general description of some of these applications is given below, together with typical hydraulic circuits.

Wire Drawing Equipment Application — Hydraulic Control

IN connection with wire drawing equipment, hydraulic drives have been applied to both single block and continuous wire drawing machines. A typical hydraulic circuit for the single block machine is shown in Figure 16. The block is driven from a fixed displacement hydraulic motor through a suitable reducer. The hydraulic supply to the motor is pumped from a storage tank by a variable displacement hydraulic pump. By varying the displacement of the pump, a speed range of up to 40:1 can be obtained.

* * *

FIGURE 17 shows a typical hydraulic diagram for a continuous wire drawing machine. This circuit provides for a variable speed drive for the first capstan, and a separate adjustable torque drive for each subsequent capstan. In operation,

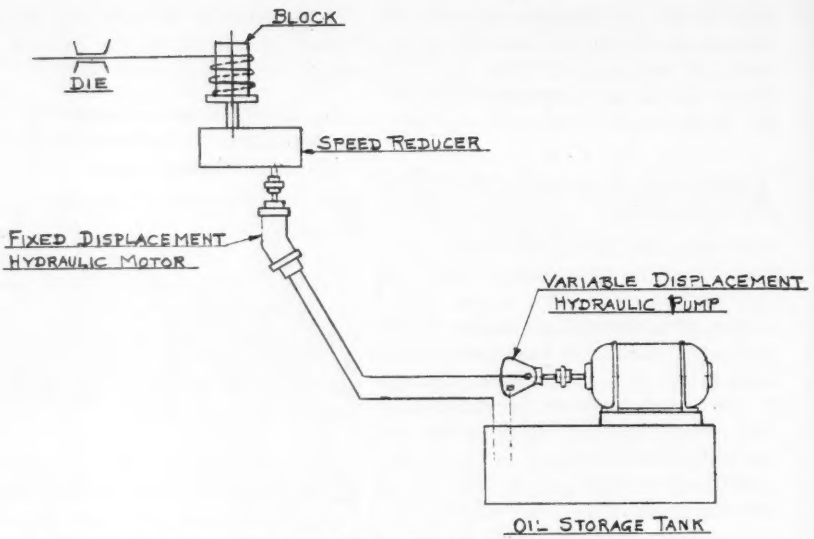

Fig. 16. — Hydraulic Drive applied to Single Block Wire Drawing Machine. * * *

each capstan drive (except the first) is adjusted so as to have torque slightly in excess of that required for drawing the wire through the die. This maintains all the capstans in proper speed relationship with the first capstan.

* * *

THE drive for the first capstan corresponds exactly to that for the single block machine just described. The remaining capstans are each driven from hydraulic motors which receive their hydraulic supply in common from a constant pressure hydraulic pump. Start-stop and flow control valves and adjustable pressure reducing valves and pressure gauges are provided in the supply lines to each of the hydraulic motors. The start-stop valves provide for threading, and the flow control sets a maximum speed at which the capstan can run, even though unloaded. The pressure gauges in the lines provide an indication of the pull at each capstan, and this can be varied by adjusting the pressure reducing valves. In practice, a chart is prepared showing the approximate operating pressures for any given run of material, and the re-

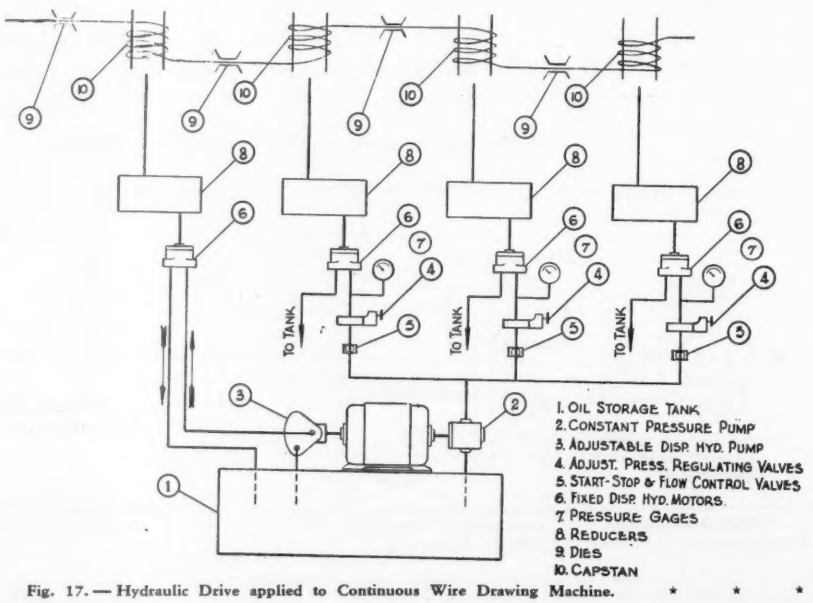

Fig. 17. — Hydraulic Drive applied to Continuous Wire Drawing Machine. * * *

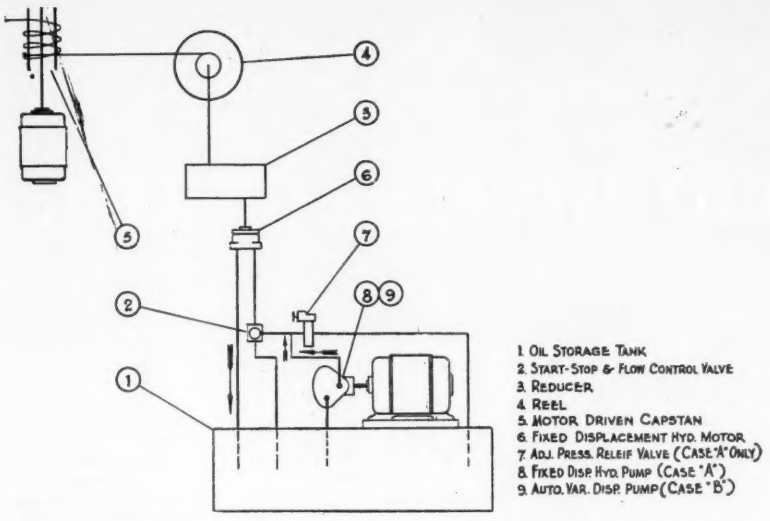
1. Oil Storage Tank
2. Start-Stop & Flow Control Valve
3. Reducer
4. Reel
5. Motor Driven Capstan
6. Fixed Displacement Hyd. Motor
7. Adj. Press. Releif Valve (Case "A" Only)
8. Fixed Disp. Hyd. Pump (Case "A")
9. Auto. Var. Disp. Pump (Case "B")

Fig. 18. — Hydraulic Drive applied to Spooling Equipment Pumping Unit Independently Driven.

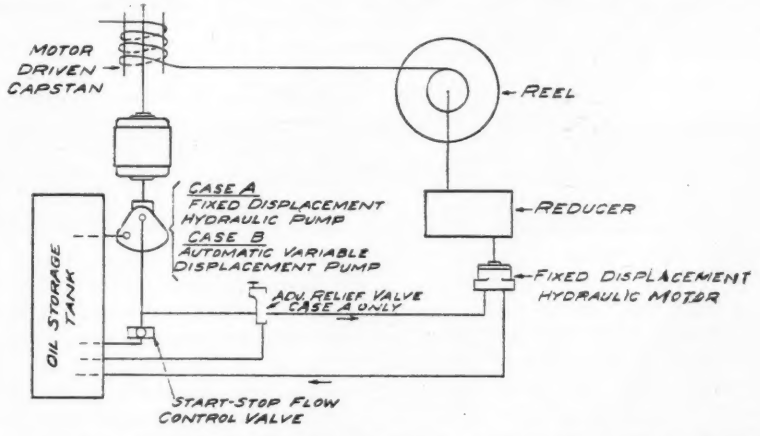

Fig. 19. — Hydraulic Drive applied to Spooling Equipment Pumping Unit Driven from Capstan Drive. * * * * * *

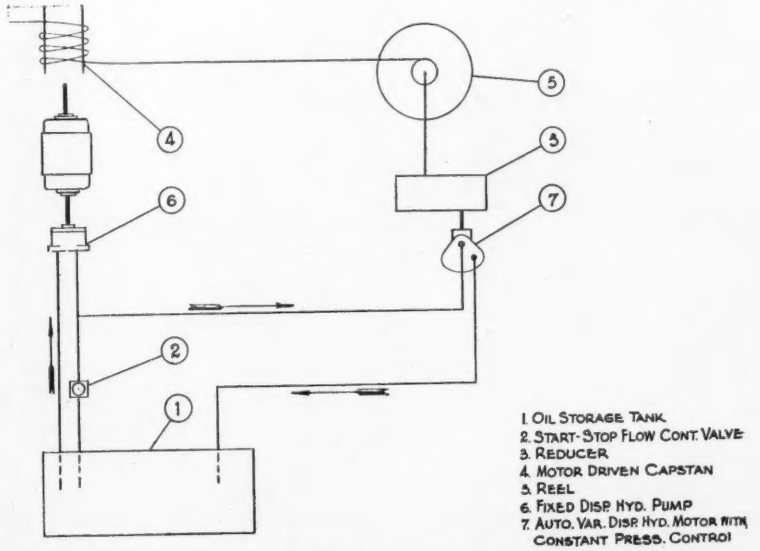
1. Oil Storage Tank
2. Start-Stop Flow Cont. Valve
3. Reducer
4. Motor Driven Capstan
5. Reel
6. Fixed Disp. Hyd. Pump
7. Auto. Var. Disp. Hyd. Motor with Constant Press. Control

Fig. 20. — Hydraulic Drive applied to Spooling Equipment Constant Tension Control * *

ducing valves are set to give correct indications on the pressure gauges. The rate of acceleration and deceleration is controlled by handwheel or electric-pilot motor controlling the adjustable displacement pump feeding the No. 1 capstan. The arrangement of hydraulic equipment described above provides a speed range of 40:1 and a range of torque adjustment of 10:1.

Spooling Equipment Application Hydraulic Speed Control

THE application of hydraulic speed and tension control to spooling equipment suggests numerous possible arrangements. Figure 18 illustrates the case in which the wire is pulled through a wire processing operation by a motor driven capstan and is then wound on a spool or a block.

* * *

THE reel is driven through a reducer from a fixed displacement hydraulic motor which receives its hydraulic supply from a separate motor driven hydraulic pump. If the amount of power required to drive the reel is small, a fixed displacement hydraulic pump can be used. This will result in constant torque being applied to the reel, the amount of torque being set by the adjustable relief valve. Where a considerable amount of power is required to drive the reel, the use of an automatic variable displacement pump is recommended. This type of pump will automatically deliver a gradually decreasing amount of oil as the coil builds up, maintaining constant torque. A start-stop and flow control valve is indicated for smooth starting and stopping.

* * *

FIGURE 19 illustrates a similar application, except that the hydraulic pump is driven directly from the capstan motor instead of by a separate A-C motor.

* * *

THE drives just described all result in constant torque at the reel. Thus, as the coil increases in diameter, the winding tension between capstan and reel will diminish. Where the range of coil diameters is not too great, this is usual-

ly not an important drawback, and in many cases, it is even desirable.

Spooling Equipment Application Hydraulic Tension Control

IN cases where it is necessary to maintain constant tension between the capstan and the reel irrespective of change in coil diameter, the scheme of control shown in Figure 20 can be used. In this arrangement, a fixed displacement hydraulic pump is driven directly from the capstan motor. This pump delivers a volume of oil proportional to the capstan speed. The reel is driven through a reducer by an automatically varying displacement hydraulic motor with constant pressure control.

* * *

CHANGES in capstan speed are reflected in the volume of oil delivered by the fixed displacement pump, and affect the speed of the hydraulic reel motor accordingly.

* * *

THE hydraulic reel motor functions automatically so that after the pressure for which the motor is set is obtained, the displacement of the motor is gradually increased with increase in load, resulting in increased torque and decreased speed. This is exactly the characteristic desired for constant tension winding where, as the coil builds up, increasing torque is required at decreasing speed.

* * *

THE amount of tension can be varied over a range of about 10:1 by adjusting the pressure control on the hydraulic motor.

* * *

THIS arrangement will maintain approximately constant tension over a range of coil buildup of up to 4:1, irrespective of changes in capstan speed.

Application of Hydraulic Drive to Three-Block Take-Up Unit

THE use of a hydraulic drive in connection with a three-block takeup unit for flat wire is illustrated in Figure 21. The three stands are pulled through the previous operations by hydraulically driven pull rolls, and are wound on three hydraulically driven blocks.

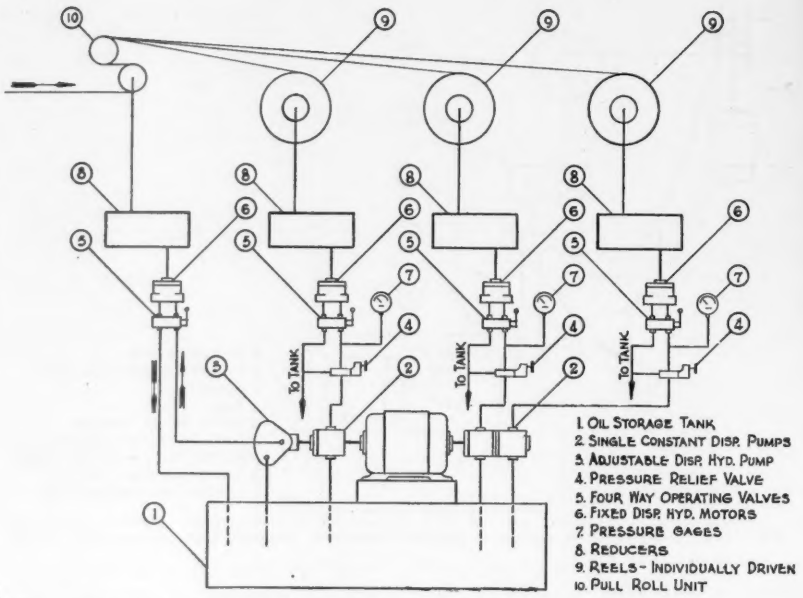

Fig. 21. — Hydraulic Drive applied to Multiple Block Takeup Frame. * * *

As will be observed from the diagram, there is a separate hydraulic circuit for each unit.

* * *

THE pull roll unit is driven by a constant displacement hydraulic motor which receives its hydraulic supply from a variable displacement hydraulic pump. The speed of the pull rolls, and accordingly, the speed of wire travel through the processing operations, is controlled by adjusting the displacement of the hydraulic pump, either manually or by remote control. A four-way operating valve and a pressure regulating valve and pressure gauge are included in the circuit.

* * *

EACH of the three blocks is driven from a constant displacement hydraulic motor, and a separate constant displacement hydraulic pump is provided for the hydraulic supply to each motor. Also provided in each circuit is a four-

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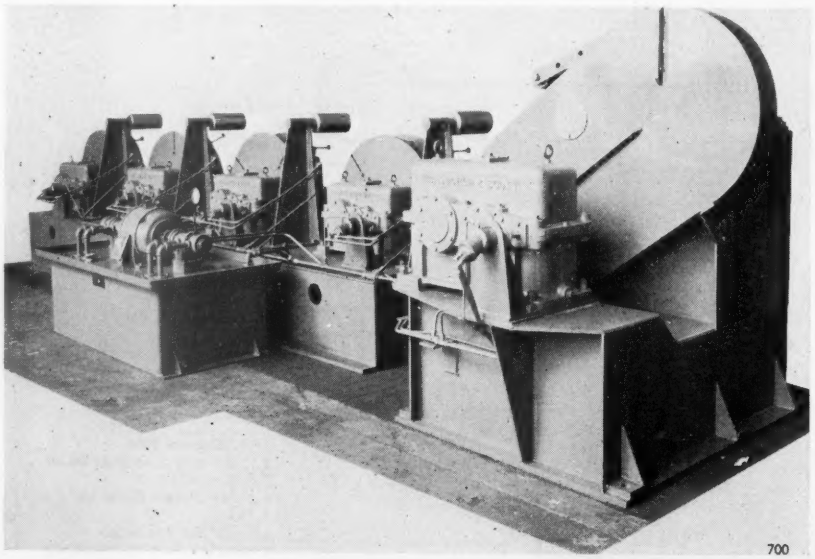

Fig. 22 — Hydraulically Driven Four-Block Takeup Unit. * * * * *

Anaconda

EXTRUDED and DRAWN COLD HEADING WIRE

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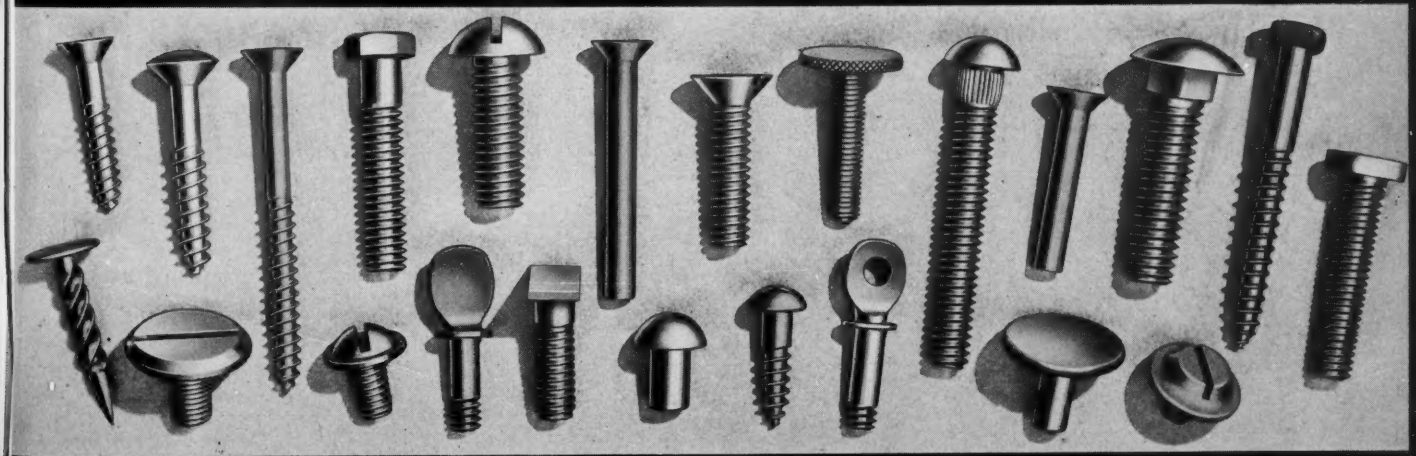
RED BRASS · PHOSPHOR BRONZE · NICKEL SILVER · EVERDUR

Next page, please...

WIRE FOR COLD HEADED SCREWS, BOLTS, RIVETS, STUDS, ETC.



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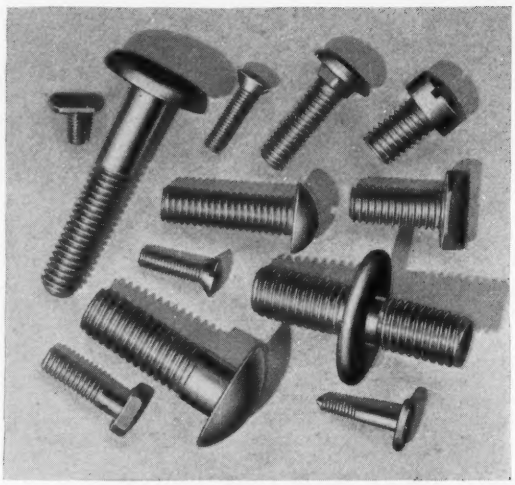

Typical machine screws made of Everdur.

Anaconda Brass Extruded Heading Wire is widely used for the production of wood screws.

These rivets were made from Anaconda Alloys listed at the right.

ANACONDA COLD HEADING ALLOYS

Yellow Brass Extruded Heading Wire—A standard yellow brass wire, extruded and cold drawn, for easy cold heading of screws, bolts, rivets, studs and accessories. Used for builder's hardware, electrical fixtures and equipment, radio, mechanical assemblies. Most widely used high brass screw wire.

Cartridge Brass (70%) Extruded Heading Wire—Another excellent extruded and cold drawn high brass wire, particularly adaptable for fabrication of fastenings with intricate shapes and contours.

Commercial Bronze Heading Wire—This alloy has good hot and excellent cold working qualities and is used for the fabrication of fastenings where appearance is an important factor.

Red Brass Heading Wire—The hot and cold working qualities of this alloy are similar to Commercial Bronze. It is used extensively where a color match with architectural bronze is desired.

Phosphor Bronze (Grade A)—Furnished in wire for special-purpose fastenings where superior strength or fatigue-resistant qualities are essential.

18% Nickel Silver Wire—A white metal possessing exceptional resistance to corrosion and ease of fabrication. Nickel Silver Wire can be obtained in all grades from 5% to 30% Nickel.

Everdur* 1015 Wire—This copper-silicon alloy combines unusual strength and toughness with high resistance to corrosion. Its uses include boat fastenings, marine hardware, poleline hardware, electrical parts, switch gear, etc. Working properties of this alloy permit the somewhat unusual operation of cold extruding in heading machines.

*Reg. U. S. Pat. Off.

48120

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General Offices: Waterbury 88, Connecticut

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Above the Ears of Men-- A Philosophy for the Future

By Kenneth Smith, President

California Redwood Association
San Francisco, Calif.

An address delivered at the Pacific Coast Regional Meeting of the Wire Association held at San Francisco, Calif., June 4th, 1948.

TWENTY-SIX YEARS AGO, at a time when we were just starting to pick ourselves up from the crash of our beautiful post-World War I dreams, I clipped from an editorial in Colliers, about competition, 28 words that I wish to pass on to you:

"The important part of the competition will take place not in factories, nor in the offices, nor on the road: IT WILL TAKE PLACE ABOVE THE EARS OF MEN."

* * *

THE idea of that Colliers editor, that the important thing in this world is what takes place above the ears of men, has lived with me all these years and today, if I may, I want to discuss with you the extreme importance of what goes on **above the ears of men** in these most critical days of our lives that lie just ahead.

* * *

BUT, before we do that, let's take a couple of minutes to do a little supposing.

* * *

LET'S suppose that your Chairman had asked everyone to stand up who is disturbed about the years ahead and recognizes that our freedom of opportunity system is in danger.

* * *

I HAVE no doubt that every man here would have risen. No businessman can possibly be unaware there is grave doubt as to whether we shall not ourselves become a collectivist state. In fact, the current definition of an optimist is a man who is uncertain about the future.

* * *

LET'S suppose that he had then asked how many had made financial contributions to one or more of the organizations that are making the most of the fighting chance we yet have to preserve our system. A very large number of you would undoubtedly have been able to stand up and be counted on that one.

* * *

BUT now let's suppose that he had asked to stand those of you who have worked out for yourselves easily understood, common sense explanations of what you think and why about government debt; about inflation; about risk capital; about jobs; about wage levels; about the tickets called money; about taxation; about regimentation — who have hammered out for yourselves your own philosophy of individualism and then made a personal contribution of your own time and energy to the saving of the system that gave you the opportunity to be what you are and where you are by reselling your employees and your neighbors on your own faith and belief in the American way.

* * *

WHAT then? How many of you could have conscientiously answered that challenge?

* * *

IN all probability no Chairman of any meeting will ever ask such a question, but I suggest to you that does not mean that you are not going to have to answer it.

* * *

THE one great issue that transcends in importance every other issue in the world today is whether coercion shall everywhere supplant freedom, whether the creeping paralysis of paganism shall again engulf civilization, whether here in America where the seemingly illimitable light of freedom has burned brightest and developed the greatest nation yet on earth we shall fail to meet the challenge of history.

* * *

EACH of us is going to take one side or the other of this question. We cannot dodge it by just ignoring it. DOING NOTHING AUTOMATICALLY PUTS US ON THE SIDE OF THE COERCIONISTS AND COLLECTIVISTS, because that is the way we are automatically headed.

* * *

MR. Earl O. Shreve, President of the Chamber of Commerce of the United States, a member of this club when he lived in San Francisco, and an old friend to many of you, said at the St. Francis Hotel recently: "America must see to its psychological defenses! . . . The time is past when each of us could safely 'mind his own business' and let nature take its course on larger matters. Those larger matters have become very much 'our business.' Unless we set the course and fix its direction others will do it for us—and in directions from which there will be no easy return . . . We face an all out offensive against our American business civilization. It is an offensive expertly organized by great masters of the strategy and tactics of confusion. Let no one shrug off the seriousness of the threat—the urgency of the challenge."

* * *

MEETING this challenge is not a job that can be done just by making financial contributions to the N.A.M., the U. S. Chamber of Commerce, the State or local Chambers of Commerce, or to the

foundation for Economic Education, important as such organizations all are to spear-heading the job.

* * *

IT is a job that must be done by you and me and the tens of thousands of business men who actually run our free competitive enterprise system. We are either going to think hard enough and clearly enough and act vigorously enough to save it or, as Mr. Shreve suggests, we are going to become pawns in a regimented nation.

* * *

WE have to do the job our schools and you and I have failed to do—teach all who are under 35 what kind of an economic system it is they were born into and what makes it tick.

* * *

WE must put an end to this eternal fighting over the division of the dollar we have that is vitiating our economy and start cooperating on getting a bigger and a sounder dollar to divide.

* * *

WE must teach all men that government is not a cow to be milked, that you can only confiscate and redistribute what thrifty men have saved in the past, and that every dollar the government spends comes out of the pockets of producers.

* * *

WE must make it clear to all men **why** no government can give you something you did not earn, or give away what you have produced to a foreigner who did not work for it, except by taking it away from someone else—either now here or not yet born.

* * *

WE **must** teach all men that a bond of the United States Government is in reality merely a promise that its citizens will pay it off with work **yet to be done by themselves.**

* * *

WE have to find a way to get all men to understand why we cannot continue to consume all we produce as we have now for 17 years, and why something must be saved from current production to buy new plants, tools, equipment, technical education—all the things that lift the productive power of men.

* * *

WE must revitalize the old American traits of self-reliance, ambition and thrift. We must teach all men again what all once knew: that the greatest motivating incentive in America has been the right and the opportunity of the individual to "get ahead."

* * *

WE must rekindle the will to work and reverse the habit of dependence on government which is slowly throttling that spirit of self-reliance which was the springhead of America's progress.

* * *

WE need to get back to the kind of thinking and kind of teaching that we were brought up on. We need to get Horatio Alger out of his grave and back in the hands of every school boy.

* * *

FREEDOM of opportunity plus work — plain old-fashioned hard work — built America.

* * *

THE philosophy of less work for more pay, coupled with bartering our freedom for a fancied "security", can destroy it as surely as it is destroying France and England today.

* * *

NOW if I were not on this platform and we were instead sitting around a table somewhere it's just about at this point that some of you would be saying: "You say it's a job that is up to me and every other businessman, but what can I do?"

* * *

WELL, I have already indicated the first and most important thing you can do—**and must do**—THINK. You must first know precisely what you believe—**and why**—and then base every business, or other, decision on a strict and rigid fidelity to that belief.

* * *

THAT will take care of your acts.

* * *

THEN you will be ready to do the rest of your job. That is to sell your own belief, your own convictions, to everyone you can reach, to everyone within the orbit of your influence, whether it be 20, or 200, or 2000.

* * *

I am not offering any easy alternative to the dilemma we face. Both of those jobs are tough. But, as I have already said, you and I and the other tens of thousands of men who actually run our system of free competitive enterprise are either going to resell it in these next few years or it won't be here to run.

* * *

THINKING is the hardest work men do. It is the work they do most reluctantly. Thinking straight about problems that are beyond our personal experience such as the effects of government interventionism on production, prices, wages, etc., the effects of deficit financing, the effects of confiscatory taxation, is strenuous mental labor. It involves real self-discipline.

* * *

THERE is more truth than poetry in the Arizona farmer's quip: "In Germany it was against the law to think; in the rest of the world it is against human nature."

* * *

NICHOLAS Murray Butler said just before he retired as head of Columbia: "All the problems of the world could be settled easily if men were only willing to think, but most of us will resort to all kinds of devices rather than think, because THINKING IS HARD WORK."

* * *

YET there is no other way to safeguard our freedoms. We cannot rely on trial and error. The trouble with economic experiments is that they cannot be conducted in a laboratory. If we continue to follow blindly political expedients of economic illiterates, do-gooders and congenital collectivists we shall flounder into an economic and political morass from which we cannot escape.

* * *

AGATHA Christie sometimes makes her famous fictional character Hercule Poirot preposterous, but she nevertheless bases his braggadocio on a very profound truth when she has him say so

frequently: "It is the brain, the little grey cells on which one must rely. The senses mislead. One must seek the truth within—not without."

* * *

BUT when you have done this first job, when you have hammered out your own personal philosophy of individualism, when you do know **precisely** what you yourself believe, then literally hundreds of ways to act on your convictions will open before you just as naturally as you put one foot in front of the other.

* * *

IT'S just a selling job—no different to selling merchandise or selling your banker on making a loan. If you give the other fellow the reasons that convinced you, he is likely to come to the same conclusion. It's like all selling, too, in that the fundamental element is sincerity. What your tongue says your heart must believe or your words will not carry conviction.

* * *

BUT if you make it your No. 1 job there is no reason why you cannot resell your workers and the people in the community in which you live on your own understanding of what makes our economy tick, and on the indivisibility of freedom—that once freedom of the market place is lost all others will fail.

* * *

Our Last Frontier

I have been dwelling so far about the necessity of doing these things just as an obligation of citizenship, to recover the freedoms we have unthinkingly frittered away, and preserve our way of life for those who come after us, but it seems to me also that this job is an absolutely essential first step that must be taken in order to lay a sound foundation for America's next great long-range pioneering job.

* * *

THAT pioneering job is the exploration and development of our last grand greatest "frontier" of all—our one illimitable "frontier"—our one greatest resource—the fund of unused human energy in our 140 odd millions of people.

* * *

IT is literally true that our really great unexplored "frontier" lies in the field of human relations, in broadening the mental horizons of men and women, expanding their skills, stimulating their zeal, increasing their accomplishments and heightening their satisfactions. We have not even scratched the surface on that "frontier".

* * *

THE psychologists tell us that in spite of our remarkable accomplishments as a nation, the average American does not develop and use 20 per cent of his capabilities. If we succeeded in lifting this only two percentage points, to 22 per cent, we would have an overall improvement of 10 per cent. The possibilities stagger the imagination.

* * *

THERE is a limitation on the quantity of workers but there is no limit on the QUALITY. If in this process of reselling Americans on the American way of life we succeed in rekindling the old-fashioned will to work and that results in stepping up the **quality**, in stepping up the use made of our inherent capabilities, by even so little as 10 per cent, it will have an incredible effect upon our economic well-being.

* * *

THE greatest field for improvement open to management—the best prospect we have for meeting management's goal of more and better goods and services at lower prices, is undoubtedly in providing an inspired leadership that will step up the thinking of men and women —will increase the **quality** of our workers.

* * *

ALL business, whether manufacturing, distribution or service, is just what the people in it make it. And what they make it depends not on the number of people but on the **quality** of the people.

* * *

HUMAN labor — mental and physical, is by far the largest element in the cost of producing the goods and services of industry.

* * *

A. H. Smith once said railroading was 95 per cent men and 5 per cent iron. Daniel Starch says a more correct appraisal of business is 85 per cent men, 10 per cent materials and 5 per cent money.

* * *

IN a recent exhaustive study he demonstrated that on a cold blooded dollar and cents evaluation the human assets of business are worth at a very minimum **fifteen** times the physical assets on the balance sheet. He summed up his study in these words:

> **"Nearly all business problems, when sifted down, are human problems. Production problems, distribution problems, financial problems, administration problems, nearly all end up as human problems. Nothing happens in business except through people."**

* * *

THE first rseponsibility therefore of management which would be successful is the development of competent, loyal, efficient service-minded people, to stimulate their thinking and step up the use of their inherent capabilities.

* * *

YOU may ask why I am so sure that the millions of rank and file workers can improve themselves if they become interested in doing it?

* * *

FIRST, I would cite the experience of men everywhere who have themselves used the little grey cells. I have no doubt at least eight out of every ten men in this audience came up out of the rank and file simply by using more of his inherent capacity than it was necessary to use to stay where he was.

* * *

AND I have no doubt, either, that most of you will admit that the margin is not wide—that all it took was just a little more interest, a little more thinking, a little more enthusiasm, a little more work—and probably admit just as frankly that you have by no means made full use of all of your inherent capabilities.

* * *

BUT let's take two everyday examples that everyone is familiar with. Driving an automobile requires the development of a whole new set of mechanical skills and ability to make instant decisions in a myriad of complicated situations. Yet, it is likely that 100 million of our 145 million population can drive.

THEN there is the pedestrian side of the same coin. Whenever you cross a street (except at a signal) you weigh the evidence of vehicles moving at varying speeds against your own ability to move to avoid them, and before you are across one street, will have made a number of vital decisions as to whether to go or wait. We have become a nation of people highly trained in weighing that kind of evidence. A man from the jungle who could run faster and stop quicker, would be in far greater danger of being run down because he would not be able to judge vehicle speed.

* * *

NOW, both of these examples are proof of a tremendous increase in the use of inherent capabilities of practically a whole nation in less than two decades. We didn't grow up a new race of people of superior abilities. It's just that everyone decided to learn to use that much of his unused and inherent capabilities that he had all the time.

* * *

WE are not discussing miracles. Yet if we got that much more interest and developed just that much more use of these inherent capabilities in thinking, making decisions, using skills, with respect to the job at which each of our 60 million workers earns his living, as has been called forth by the advent of the automobile, the over-all result could well seem miraculous.

* * *

THE whole problem is creating interest, stimulating thinking, arousing desire.

* * *

WE have doubled, quadrupled and in many instances multiplied the efficiency of our machines by hundreds and thousands, and we see to it those machines are kept in good to perfect working order, but we have done very little about increasing the skills of men and women or about keeping either their physical or mental condition in good working order.

* * *

ON the contrary, the effect of the efficiency of our engineers has too often been to break down traditional skills of artisans in the interest of mechanization without doing anything to compensate for the breakdown of the traditional pride and interest that were the counterpart of high skill.

* * *

BY-AND-LARGE, management has lacked the "social skill", the innate understanding of social realities, the recognition of and belief in the dignity and ego of man, that is essential to the building of morale and that spontaneity of cooperation which is the essence of teamwork.

* * *

THAT is understandable when we remember how this country was built and how fast it was built, but it does not alter the fact that in the process of mechanization we have lost that cohesiveness and mutuality that once characterized our people.

* * *

WE face now the gigantic task of bridging over these chasms of misunderstandings and loss of faith in individual opportunity.

* * *

WE must find a way to spin these tiny wires of individual ability into sturdy cables of cooperative strength if we are to reunite our people in a common appreciation of our heritage and a renewal of faith in the opportunity it offers them.

* * *

PEOPLE are largely what leaders make them. Their **attitude** governs their actions and their attitude is primarily the reflection of what they **think** is the attitude of management. It is because people inevitably reflect what they think is the faith, aspiration, interest and attitude of management, that we who are leaders MUST look long and deep into the quality of **our** faith, **our** aspirations and **our** convictions.

* * *

MR. James C. Worthy put this very plainly before the American Management Association recently in these words:

"...attitudes are largely a product of experience. If the worker's experience on the job causes him to dislike and distrust management, no amount of 'education' will change his feelings or behavior."

THE morale of an organization does not well up from the bottom, it filters down from the top.

* * *

IRRESPECTIVE of what workers read or hear, they will make up their own minds about the merits of our freedom of opportunity system, largely on the basis of the conduct of and their contact with that particular unit of it for which they work. Deeds mean far more to all of us than words. Edmund Burke, said 200 years ago:

"It is by imitation, far more than by precept, that we learn."

* * *

THAT is why I keep saying over and over that the job must be done by you and me and the tens of thousands who actually run our freedom of opportunity system.

* * *

ADVERTISEMENTS, speeches, pamphlets can and do prepare the way, but in the final analysis men are only going to be resold on the American way by seeing it demonstrated. It takes people to sell people.

* * *

MANY highly successful men have been so long accustomed to having their orders and wishes obeyed without question that they have all unwittingly lost that innate sense of human action and reaction that is essential to influencing people.

* * *

TOO many of us, far too many, don't know **precisely** what we do believe, or why. We work too hard and think too little.

* * *

THE burden upon leaders is to lead. The burden upon managers is to manage. But if we are to measure up to our responsibility, we must evolve, **each for himself,** measures and means for advancing this new concept of human relations.

* * *

WE have to recognize that every worker whether he be the cashier of a bank or loads lumber on a truck wants respect as an individual, that he wants to stand on his own feet and that he resents paternalism.

(Please turn to page 795)

Automatic Equipment for De-Burring Bolts and Nuts

By N. Ransohoff, Chief Engineer
N. Ransohoff, Inc.
Cincinnati, Ohio.

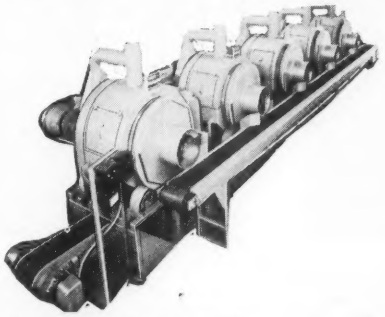
WHEN a large bolt and nut manufacturer in the East recently replaced his old style flat type tumbling barrels with modern tumbling equipment, it was discovered that he could now de-burr his work in 42% of the former time with only 20% of the labor formerly required. Thus, labor costs not only were reduced radically but the capacity of the cleaning room was more than doubled. This is sweet music to the ears of cost minded production men these days where every effort is being made to cut costs as deeply as possible.

* * *

THIS particular plant was faced with the problem not only of de-burring, but also of removing the flash, as well as cleaning the punch press oil and grease from approximately 5,000 pounds of bolts and nuts during manufacture. The bolts must be cleaned of oil and grease, as well as de-burred and de-flashed, before threading, while the nuts are processed in a like manner after tapping. Sawdust is the logical tumbling material to use because most bolt and nut manufacturers make their own packing boxes or kegs, so that the cost of sawdust is very small. In addition, sawdust tumbling possesses the advantage of not removing all of the oil from the work but leaves a thin film for rust protection.

* * *

THE accompanying photograph shows the de-burring machine. The conveyor located at the rear of the equipment is used for loading the work into the tumbling barrels. The conveyor is equipped with a hopper at the lower end so that the operator can load as many as five tote pans of work into the hopper at one time. The conveyor transfers the work to the proper tumbling barrel, and a sweep... sweeps the work into the proper tumbling barrel. The sweeps are manipulated by the operator from the charging end of the conveyor by means of cables and levers. The operator selects the proper sweep and pulls the lever which swings the sweep from the edge of the conveyor into a position where it can direct the work into the loading chute of the tumbler. The sweep is unique in that it is supported by a caster which permits only a 1/64" clearance above the conveyor belt. As the work is being loaded into the proper barrel, the operator places about 3 shovels full of sawdust onto the same conveyor which in turn is also swept into the barrel. He then slips the lever and a counterweight returns the sweep into its proper position off to one side of the conveyor. Each of the 5 tumbling barrels is equipped with a time switch which can be set manually to run for the proper length of time. Some work from which it is necessary to remove only the oil and grease may be run for only half the time that is needed for other work where it is necessary not only to remove the oil and grease but to also de-burr and remove the flash.



Ransohoff De-Burring Machine.

* * *

WHEN the work is tumbled with sawdust, the sawdust is continuously sifted out from the work through grizzlies set in the drum shell. Thus the sawdust as well as the pieces of metal flash drop down through the grizzlies onto a continuously moving conveyor belt set beneath the battery of 5 machines. The tail end of the conveyor is equipped with a magnetic separator which automatically removes all metal particles and discharges the sawdust into one receptacle and the metal particles in another receptacle. The metal is sold for scrap and the sawdust is burned on the dump. After the work has been tumbled for the proper length of time the barrel automatically stops and when ready the operator merely pushes a button to rotate the barrel in the opposite direction, automatically unloading the work onto the conveyor which is shown in the illustration mounted on the front of the equipment. This conveyor is used to bring the work back to the loading end of the equipment where the operator has placed 5 tote pans which are clipped together and rolling on a roller conveyor. Thus it is necessary only to pull the train of tote pans across the unloading end of the conveyor until all 5 tote pans are filled. The tumbling units are each equipped with an exhaust nipple mounted on the hood so that any flour from sawdust is removed by means of a suction blower.

* * *

TO sum up the operation of this equipment, one operator dumps 5 tote pans of work into the hopper mounted above the loading conveyor. He pre-sets the sweep to sweep the work into the proper tumbling barrel and the conveyor conveys the work into the proper barrel. While the work is tumbled, the sawdust and metal particles are automatically separated. Dropping down to the conveyor mounted beneath the equipment the metal particles are magnetically separated from the sawdust. After the proper tumbling time has elapsed, the barrel automatically stops, indicating to the operator that it is ready to unload. He then merely pushes a button which starts the barrel rotating in the unloading direction. The work is automatically unloaded onto the unloading conveyor where it is then conveyed to the 5 tote pans which the operator has previously placed under the unloading end of the conveyor.

View of some Operations in the Rod and Wire Mills of the Columbia Steel Co., Pittsburg, Cal.

(PLANT INSPECTION TRIP JUNE 8, 1948 BY THE WIRE ASSOCIATION)

FIG. 1
FINGER-TIP CONTROL is exercised by this pulpit operator in the continuous rod mill of Columbia Steel Company's Pittsburg (Calif.) Plant. Through the large window in the pulpit the operator has a sweeping view of the mill and is able to watch the red-hot rods snake from the furnace at the left through the many passes into the automatic coiler. A flick of his finger controls the speed of the rolls at any particular point enabling the operator to take up slack or to ease the strain on the rods as they whip through the mill at high speed. * * *

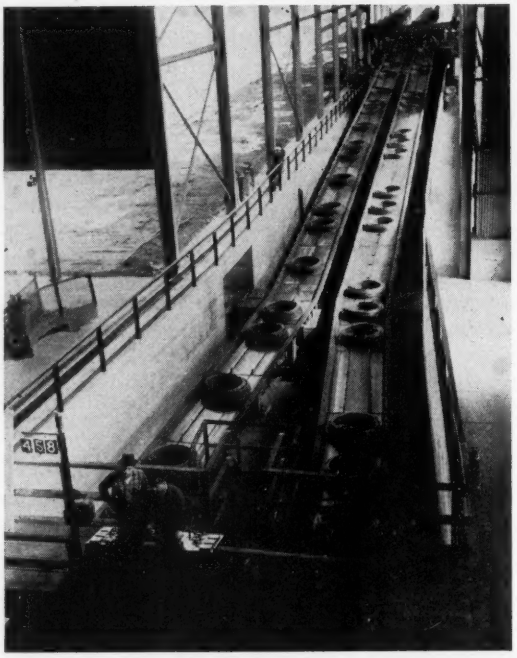


FIG. 2
Finished rods, over 5,000 feet long, coiled on conveyer where they are automatically, cooled, and inspected, and placed in stock piles to be used by the wire mill for making welding rod. Cooling hot rolled rods in air produces a thin coating of scale (iron oxide) which is removed by pickling. Employees shown are Veri Taylor and Fred Del Monte. * * * * *

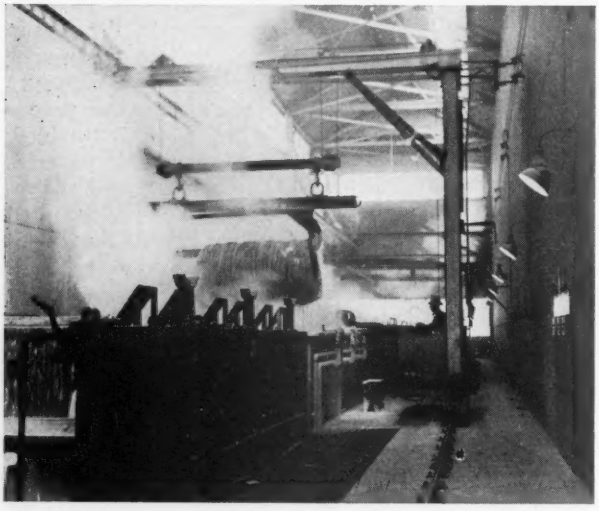


FIG. 4
Pickling. In this operation the rods (7 coils to the stem) are immersed in a tank of diluted hot acid. After cleaning, the excess acid is rinsed off the rod by use of high pressure water spray. Next, the rods are dipped in milk of lime to neutralize any remaining acid. Finally, the lime coating, which facilitates cold drawing, is dried in a flash baker. Crane Operator, Albert Smith, is transferring a stem of rods. * * * * *

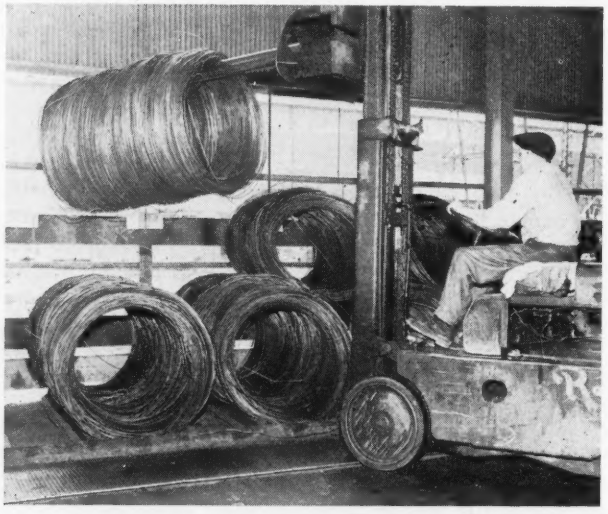


FIG. 3
JOUSTING HOT COILS of rods with a loader shaft is the daily feat of Bert C. Murphy, Pittsburg, California, a rod loader in the U. S. Steel's Columbia rod mill at Pittsburg. Most of these rods are drawn into wire at Pittsburg, and then further processed into nails, staples, fencing, springs and numerous other end products. Billets 30 feet long and 2⅝ inches square are passed thorugh 21 stands of rolls, and race out at the rate of 40 miles an hour onto coiling reels. These rod coils are what Murphy is shown loading onto railroad cars fom shipment to the wire mill of the Columbia plant at Pittsburg. In one month of 1944 this rod mill set a war production record by rolling 4,000 tons of welding wire for western shipyards. *

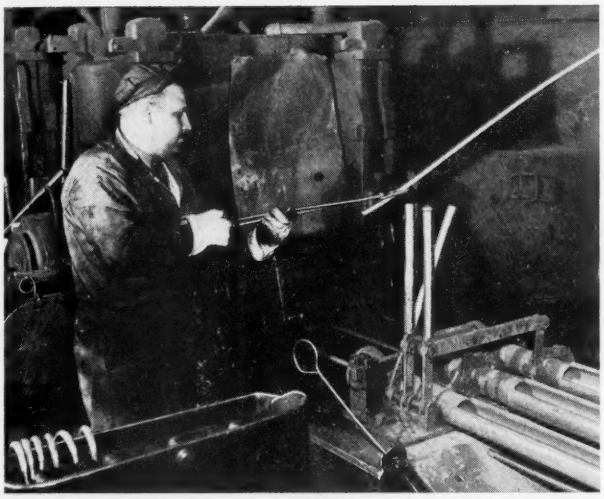


FIG. 5
PICKING MUSHROOMED ENDS WITH TONGS is the job of the flying shear operator in U. S. Steel's Columbia rod mill, Pittsburg, California. Holding out a hot steel mushroom is James C. Wood, Jr., of Pittsburg, a mill spell hand. He is operating the flying shear which cuts the ends off the bars after they have mushroomed in going through three stands of rolls while red hot. Each mushroomed end has to be picked from the track and thrown out so as to clear the way for oncoming billets. If the mushroomed ends were not cut off, the bars would not go through the remainder of the 21 rolls. This would block the mill, causing a shut down, since at one point where the rods loop from one roll to another, they travel at the rate of 2,000 feet a minute. * * * * * *

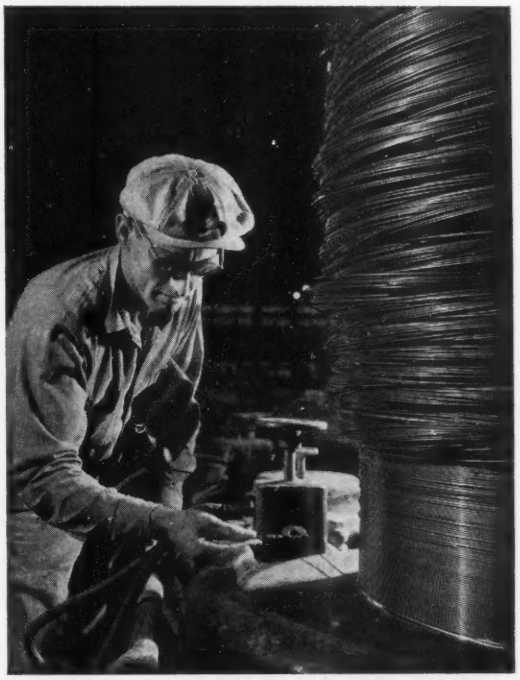


FIG. 6
WIRE DRAWING IS PRECISE at Columbia Steel Company's Pittsburg (Calif.) Plant. Here an employee guages the wire to a thousandth of an inch as it is pulled through the die of a modern continuous wire drawing machine. * * *

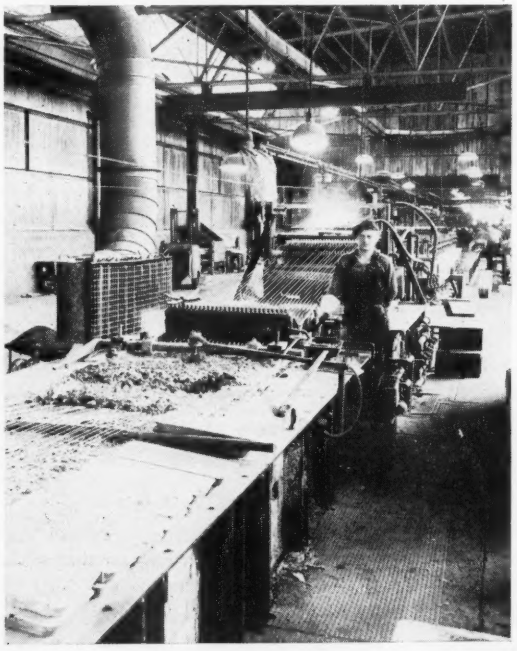


FIG. 7
SHINING GALVANIZED WIRE comes from this hot bath on the continuous galvanizing line in the Wire Mill of Columbia Steel's Pittsburg (Calif.) Plant. On leaving the zinc bath, the wire is wiped for even coating and is then cooled rapidly with water to give it a bright galvanized appearance. After coiling, the wire is ready for distribution to Western markets. * *

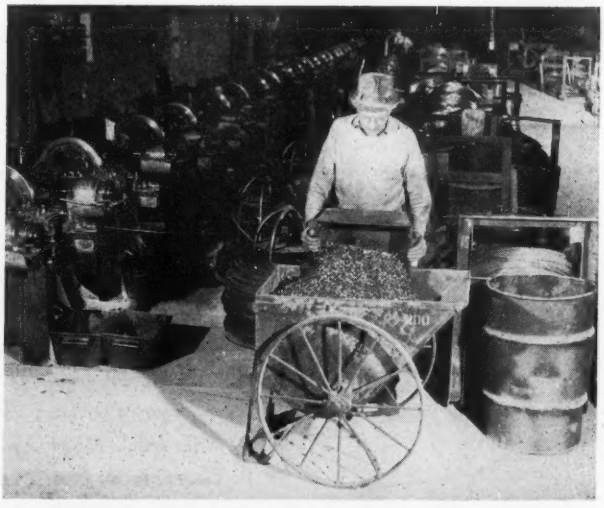


FIG. 8
NAIL-MAKING MACHINES — Flanked by a long row of modern, motor-driven, nail-making machines, Isham A. Byrd is shown dumping a full box of nails from a machine into a nail-buggy. This row of nail-making machinery is only one of many operating in the Nail Mill at the Pittsburg, California, Plant of Columbia Steel Company, a United States Steel Corporation subsidiary. Wire is shown feeding into the nail machines, which shear the wire to nail size, form the head, and shape the point. * *

TENTATIVE PROGRAM

The Wire Association Annual Convention

William Penn Hotel, Pittsburgh, Pa. — October 18-22, 1948

(This Tentative Program is Subject to Change Prior to the Convention)

MONDAY, OCTOBER 18

Morning Events
Registration

Directors' Meeting — 10:30 A.M.

Program Committee
Meeting and Lunch — 12:30 P.M.

* * *

Afternoon Session — 2:00 P.M.

"Practical Development of Modern Wire Drawing Compounds".
by E. L. H. Bastian, Staff Engineer
Shell Oil Company
New York, N. Y.

* * *

"Fumes and Ventilation in the Wire Mill"
by Wallace G. Imhoff, President
The Wallace G. Imhoff Company
Los Angeles, Cal.

* * *

"Practical Applications and Mill Practice with Carbide Dies"
by E. T. Miller, Die Service Engineer
Firth Sterling Steel & Carbide Corp.
McKeesport, Pa.

TUESDAY, OCTOBER 19

Morning Session — 10:00 A.M.

"The Control & Production of High Carbon Wire"
by Jerry G. Weiss, Supt., Patent and High Carbon Wire Dept.
Keystone Steel & Wire Company
Peoria, Illinois

* * *

"Inhibitors"
by Carl A. Zapffe, Metallurgist
Baltimore, Md.

* * *

Afternoon Session

Plant Inspection Trip to Wire Dept.,
Jones & Laughlin Steel Corporation
Aliquippa, Pa.

WEDNESDAY, OCTOBER 20

Morning Session — 10:00 A.M.

Paper by Mr. Reginald S. Brown, Chief Met.
Rylands Bros., Ltd.
Warrington, England
With discussion by
Mr. Geoffrey K. Rylands

* * *

"Wire Drawing Research in the British Iron & Steel Research Association"
by W. Hessenberg, Head of Mechanical Working Division
British Iron & Steel Research Association
London, W.I., England.

* * *

Afternoon Session — 1:00 P.M.

Wire Association Luncheon
The Mordica Memorial Lecture to be presented by
C. L. McGowan, Supt., Rod and Wire Mill
Atlantic Steel Co.
Atlanta, Georgia

* * *

4:30 P.M.
Wire Association Annual Meeting

* * *

7:30 P.M.
Annual Dinner Stag Smoker

THURSDAY, OCTOBER 21

Morning Session — 10:00 A.M.

"Rope Wire"
by John Corson, Research Engineer
John A. Roebling's Sons Co.
Trenton, New Jersey

* * *

"Quality, Quantity & Service"
by N. T. Nelson, Jr.
Rod & Wire Mills
Bethlehem Steel Company
Sparrows Point, Md.

THURSDAY, OCTOBER 21

Afternoon
Plant Visit to
Westinghouse Electric Company
East Pittsburgh, Pa.

FRIDAY, OCTOBER 22

Morning Session — 10:00 A.M.
Two Non-Ferrous Papers

"Hot Dip Aluminum — Temperatures and Methods of Application"
by Clarence Ulschaffer, Metallurgist
Hughesville Machine & Tool Co.
Hughesville, Pa.

* * *

"The Processing of Brass Wire"
by Chris Witterveld, Jr.
Bridgeport Brass Company
Bridgeport, Conn.

* * *

Afernoon Session — 2:00 P.M.

"New Materials for Wire and Cable Applications"
by H. L. Wuerth, Geon Division
B. F. Goodrich Chemical Co.
Cleveland, Ohio

* * *

"Fatigue Testing of Wire"
by F. A. Votta, Jr.
Hunter Spring Co.
Lansdale, Pa.

* * *

"A Method For Measuring Lubricant Effectiveness in Non-Ferrous Wire Drawing"
by C. B. Shopmyer, Apparatus Dept.
General Electric Co.
Schenectady, N. Y.

All papers received by September 1st., will be preprinted in the October 1948 issue of Wire and Wire Products. Papers received later will be published in the November and December issues.

The discussions and Mordica Memorial Lecture will be published in the January 1949 issue of Wire and Wire Products.

ALL WIRE MILL MEN ARE INVITED TO ATTEND

There is a Registration Fee of $5.00

For Hotel Reservations Write

RICHARD E. BROWN, EXECUTIVE SECRETARY

THE WIRE ASSOCIATION, 300 MAIN STREET, STAMFORD, CONN.

INDUSTRIAL DIAMOND ASSOCIATION
OF AMERICA, INC.

STEPHEN W. HOFFMAN, President CHARLES J. KOEBEL, 1st. Vice-President WALTER J. MEINHARDT, 2nd Vice-President

Communications:
ATHOS D. LEVERIDGE
EXECUTIVE MANAGER
& Secretary-Treasurer
501 LEXINGTON AVENUE
NEW YORK 17, N. Y.
WICKERSHAM 2-1400

For Good Productivity In Diamond Dies

An Open Letter to the Wire Manufacturing Companies

By Athos D. Leveridge, Executive Manager

THE world-wide inflationary condition has brought about a situation in the Diamond Die Industry that has never before existed in its short history.

* * *

WITHIN the past week (August) diamond boart has increased 33% in the American market, with further increases predicted. This, with all of the continuous increases over the past few years, in labor, die stones, and all other raw material, and the fact that larger size dies still sell for about the same as in 1934, makes it advisable to alert the wire mills in this country to a situation for consideration when purchasing dies.

* * *

THERE are ways for some diemakers to get around the problem involved by the above situation, for a period of time, as it is difficult for a wire manufacturer to know what quality of diamond is used in the die he purchases. But such procedures can only result in smaller or poorer quality stones or a combination of both, from all diemakers, sooner or later. Also, in spite of ideas held by some, it is impossible to determine by examination of the mounted die itself, the quality of the work that has been done to the diamond to make it a good die.

* * *

BY modern methods, several wire manufactures are in a position to know just what the different drawing operations are costing. Through the systems they had established, many companies became prosperous because they knew, at every step, just what they were getting for what they were spending.

The first of a series of letters directed to The Wire Drawing Industry. The next letter in the series will deal with the necessity of knowing the value of diamond dies, in terms of production, by means of practical production records.—The Editor.

WHERE a firm is satisfied that its die cost in its wire production is the same or less, than with other wire companies, comparative studies of die cost per pound of wire are scarcely necessary — that is, if all operations are on an efficiency basis. However, if a wire drawing company finds that it is not getting the yield of wire per die that it should be getting in order to meet competition, then poundage records "per die" are needed. Methods for doing this accurately need to be prescribed by specialists in such studies.

* * *

IN order that such a serious situation might be avoided, a more understanding attitude toward the die makers needs to be inaugurated in most wire manufacturing plants. The diamond die industry has come into modern age, technically and economically, and it can not survive under business conditions of a past generation.

* * *

PROGRESS has been very great in the techniques of die making, and in better trade practices of the diamond die industry. At least, as to the majority of the diemakers. But, it is predicted that unless a reasonable attitude is adopted toward those who are striving against so many odds to produce an honest item for maximum production, the clock will be turned back. The diamond die factor in the cost of producing wire then will become a much greater one, a real factor, through the deterioration of dies in size of stones and poorer diamonds.

* * *

THE Association earnestly invites wire manufacturers to assist the efforts being made by writing to its Executive Manager, any practices in the die making industry which it considers harmful. And it welcomes ideas and suggestions, both of a technical and business nature that might result in improved diamond dies and service by diemakers. It is only fair, furthermore, that in calling the attention of wire manufacturers to the difficulties encountered by diemakers that the Association be placed in a position to make representations to the diemakers on behalf of the wire manufacturers. This is all in a sincere, timely effort at mutual assistance and I.D.A. greatly appreciates the cooperation of the Wire Association in assisting industry in this effort.

* * *

THE facts in this case can best be told frankly by an institution such as the **Industrial Diamond Association of America, Inc.**, including as it does some 90% of all of the importers and dealers in industrial diamonds and of the manufacturers of diamond tools in every category.

* * *

THE Industrial Diamond Association felt impelled to write this current, urgent series of letters so as to forestall the deterioration that

(*Please turn to page* 805)

LABOR RELATIONS

By John B. Stone
Washington, D. C.

The seventeenth in a series of articles on the subject, with particular reference to problems of the wire and wire products industry. The author is a noted authority on the subject.

FAILURE of the Federal Government to do anything substantial to halt the dangerous onrush of inflation in the United States makes it almost a certainty, in the opinion of most serious minded labor relations observers here, that another "showdown" with labor will come, perhaps even before the "third round" fight is completely settled.

* * *

WHATEVER form this new "showdown" may take, these observers believe, the small and medium size manufacturers, including fabricators of wire and wire products will be harder hit than the "big boys" of the great corporations.

* * *

SINCE it is a foregone conclusion now that the Government is powerless to halt the tide of rising prices, economists and observers in the Department of Labor and national union headquarters here see three possibilities in the next nine or ten months of American labor relations.

1. If inflation does not give way to a "bust" or at least a serious depression within that time, manufacturers and producers will be confronted with a well organized, possibly a desperate, demand for a fourth round of wage increases to keep up with the rising cost of living.
2. If a depression does come before labor contracts expire, the "show down" will come over maintaining present wage scales despite the drop in business.
3. Should the present cold war and rearmament program step up to become a hot war and all out armament, labor is considered unlikely to go willingly into another no-strike pledge period without a prior boost in wages to meet living costs which under those circumstances would continue high.

* * *

MOST labor economists and many governments experts in private conversations expect the "recession" or "bust" to come sometime this Fall, possibly after the elections. Though their forecast vary from a serious depression to a "bust" that will be even worse than 1932, these groups agree that serious consequences are now inescapable.

* * *

BUT the official Government warnings, in the midyear report of the President's economic board of advisers and in the statements of federal reserve board officials, are hazy about when the axe will fall. Pinned down the guesses range from a few months to several years.

* * *

BUSINESS economists for the most part attempt to write off the whole adjustment as a "recession" and indicate that it will be merely a slackening of business which will not have serious consequences.

* * *

HOWEVER, the fact remains that if the recession, depression, or bust, has not set in within the next ten months, labor will be very emphatic in its demands for higher wages, because according to practically all economic charts the prices of cost of living commodities will continue rising until the reaction does set in.

* * *

THE demand of labor in case of continued inflationary good times, will be frankly a demand for the right to keep on living at current living standards.

* * *

ON the other hand if the recession has set in by the time of the next general labor negotiations, the labor demand will be based on a completely different contention.

* * *

THE labor negotiators will in that case contend that labor has not been getting its fair share of the production pie. They will declare that during the post war years profits rose much more rapidly than did wages, that the manufacturer and producer hogged most of the pie for himself.

* * *

THEY will insist that by keeping wages at the current levels, even though business has fallen off, they will only be getting a fairer share of the rewards of production.

* * *

DESPITE the big war talk by top brass and the elaborate mobilization plans of the government, most experts in private conversations agree that there isn't much real chance of war this year. All the Government plans are aimed at hitting readiness for war in five years.

* * *

THEY agree also that our armaments and Marshall plan production will not be extensive enough to maintain prosperity by themselves.

* * *

THEY argue that if war should come, both labor and management will be under closer curbs this time than they were in World War II.

* * *

GOVERNMENT spokesmen declare that both labor and management will be forced to accept a freeze of wages and profits. However, economists for both labor and big management accept this with a grain of salt. The labor strategists declare that the Government woudn't dare freeze wages without some adjustment.

* * *

WHICHEVER of the three possibilities does materialize, however, it appears certain that the small manufacturer cannot under any circumstances sit back and figure that his labor troubles are over.

Foreign Notes

THE French domestic prices for wire nails and fencing wire have been reduced by 5%. Export prices are maintained, but demand for French wire products for export has been small recently.

* * *

THE money reform in Germany leaves — as anticipated — the wire industry in a severe plight. The unfavorable relation between production and costs has been further accentuated, so that in May, the wire industry had 132% more workmen per ton, than in May 1937. Other production costs have also risen sharply. The outlet to sell a great part on the "grey market" has become impossible now, as nobody has the money to pay the prices asked, and though the complete lack of everything continues, factories have to close down. It is now possible to buy nails, or fencing material, but all the consumers continue without these, because their money hardly buys the minimum quantities of food for daily use.

* * *

THE exodus of trained workmen from the Western zones of Germany to the Eeastern zone is continuing on a very large scale. It is estimated that from Krupp's staff alone, more than 5,000 have already left for the Russian zone. The majority of all Germans do not care a bit whether they live under a democratic or a totalitarian government. All they care for now after many years of hunger, of impossibility to find a decent dwelling and enough clothing, is sufficient food and a bed to sleep in, and that is offered by the Russian zone. The food is approximately 35-40% higher, pay is better and the workmen get rooms to live in. The circumstance, that the armament industry in the Russian zone is booming and the Russian State Trauts can sell regardless of costs, is responsible for this fact. Some smaller wire works in the Western zone closed down in June, because almost all their staff went to the Eastern zone.

* * *

THE recent Swedish-Spanish Trade Agreement includes also wood screws, cables, high tension steel wires and similar products, which Sweden will exchange with Spain for fruits, etc. France is sending to Spain approximately 5.500 tons of cables and other overhead electric power transmission material. The trade agreement with England includes machinery for the Spanish wire industry and other equipment and a complete cable factory, wire screen and some smaller quantities of hexagonal wire netting.

* * *

ON the export markets, neither Pakistan or India has shown the anticipated buying movement for wire products, but Indonesia has after three years started buying, though business is very difficult, as the merchants ask for credit and

MICROMETER PRECISION MICRO WELD TRADE MARK REG. U. S. PAT OFF.

MODEL H-T MICRO-WELD HEAVY BUTT WELDER

A general utility Butt welder for welding Steel (low carbon rods and wire ranging in size from 1/8" to 7/8" diameter.

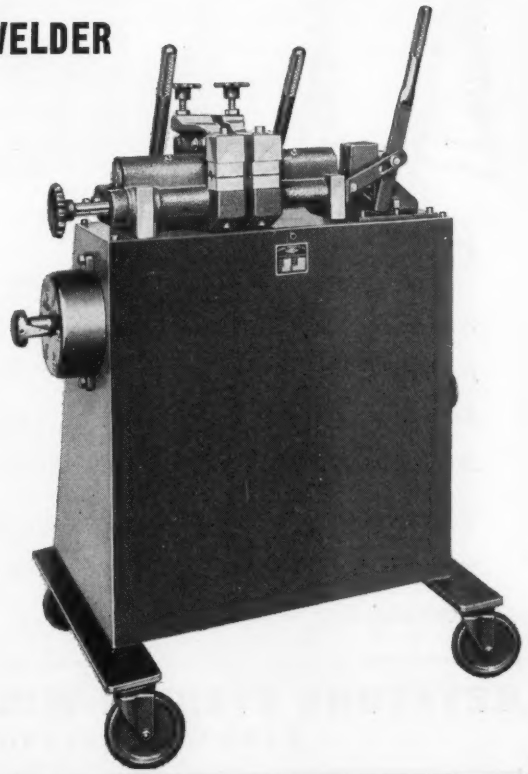
While this unit was not designed for production line work, the wide range in welding capacity makes it suitable for various types of welding requirements.

Equipped with hand-operated toggle type clamping mechanism, providing positive clamping of the stock.

Spring actuated movable welding headpiece and close coupling of the transformer provides high efficiency on the welding current.

General construction of this unit is rugged to resist high upsetting forces, and to maintain accurate alignment of the work.

Furnished mounted on 4-wheel truck as illustrated.



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CHICAGO 6, ILL.
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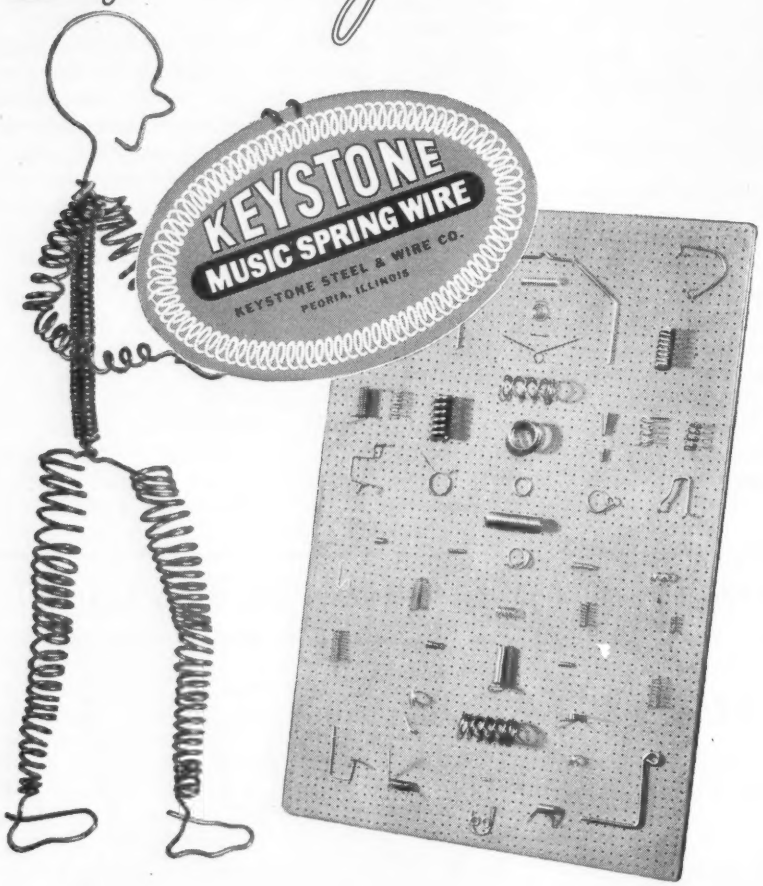
MUSIC
Spring Wire



Uniform by all the measurements of quality spring wire. Rigid control of chemical composition and processing methods assure its uniformity and structural soundness. Our specialized coiling, twist and bend tests are added safeguards of dependability.

You can depend on Keystone Music Spring Wire — as well as our other manufacturers' wires — to satisfy your most exacting requirements.

KEYSTONE STEEL & WIRE COMPANY
PEORIA 7, ILLINOIS

nobody is willing to give any. The Latin American markets are very quiet, with exception of Peru, Venezuela and Columbia, which continue to place orders. The African markets, as a whole, are showing signs of renewed buying, particularly South Africa, which is demanding wire netting, annealed wire G-14, and screen. The Near East continues to buy fairly well in proportion to the usual reduction of general volume.

* * *

THE Portuguese wire industry will re-equip part of the plants with French wire machinery under the new trade agreement. This concerns mainly wire nail machines.

* * *

Black Industries Announces a New Line of Nail Machines

BLACK Industries, 1400 East 222nd Street, Cleveland, 17, Ohio, have designed and built a new line of high-speed nail machines, that they demonstrated at a showing in their plant from August 16th to 21st. These machines were ably demonstrated at the showing and met all requirements in addition to being streamlined and very efficient.

* * *

Relocation of Steel Fabricating Plants

RELOCATION of major steel fabricating plants will receive increased consideration this summer as the result of changes in the multiple basing point pricing system of steel, a survey of prominent Pittsburg, industrial leaders showed recently.

* * *

"THE new pricing method gives fabricators who locate in a steel center such as Pittsburgh a very special advantage in being able to avail themselves of lower steel costs," **Benjamin F. Fairless,** president of United States Steel Corporation, said recently. The new steel 'pricing-at-the-mill' method would effect considerable savings in freight costs to fabricators whose

plants are located near major steel centers.

* * *

THEODORE F. Smith, president of Oliver Iron and Steel Corporation, warned that "under the present situation, all fabricators that are unfavorably located with regard to steel supply may face extinction at the hands of more favorably located competitors."

* * *

TWO large industrial firms in other cities are already making serious investigations of plant sites in the Pittsburgh district, according to **Alan M. Scaife,** chairman of the Industrial Development Council of Pittsburgh Chamber of Commerce. He reported an increasing number of inquiires from fabricators located in other sections of the country since the announcement of the pricing change.

* * *

UNDER the new pricing system **Scaife** pointed out that steel fabricators will have to absorb freight costs from suppliers as well as to customers thus adding considerably to the final price. Costs of hauling steel from suppliers will be an important factor as long as fabricators are faced with buying steel from suppliers in several geographic locations to ensure adequate stockpiles.

* * *

SCAIFE pointed out that Pittsburgh, the nation's leading steel producing center, is also the center of the largest and wealthiest market area in the country and that many firms would be able to reduce distribution costs as well. "Pittsburgh is served by five maiors railroads which ensure overnight service to the East, South and Middlewest."

* * *

ABUNDANT supplies of raw materials normally required by metals fabricators are available in the Pittsburgh area, **Scaife** said. He also stated a considerable unused labor reserve would be available to new firms.

* * *

AN ADVERTISER likes to know his ads have been read. So please mention Wire & Wire Products when writing them.

EDITORIAL NOTE

It has been brought to the attention of the Editor that an error was made in the full page plate advertisement of the MAGNUS CHEMICAL COMPANY, in our August 1948 issue, on page 638. Under the paragraph headed "Procedure", the end of the third line should read "(14 oz of #267 to one gallon of water)". This correction is printed in order to assist our advertiser in correcting this error.

NOTICE TO SUBSCRIBERS

the 1948

WIRE & WIRE PRODUCTS BUYERS GUIDE

and Year - Book of the Wire Association

The 1948 Edition of this useful directory may be obtained by subscribers at 40% discount from the list price of $5.00 per copy. So when ordering your subscription to WIRE and WIRE PRODUCTS, if you want a copy of the BUYERS GUIDE, please enclose $3.00, or send the order and ask us to bill you.

Members of the WIRE ASSOCIATION continue to receive a copy of the BUYERS GUIDE as part of the service extended to them, and the cost is included in the dues.

To all others the price remains as heretofore

$5.00 per copy.

THE BUYERS GUIDE is a complete directory of all kinds of wire and wire products manufactured in the country, together with listings of all machinery, equipment, supplies and services used by the Wire Industry.

It is an invaluable source of information on everything of interest to wire men. Be sure to order your copy now to be certain of getting one, as the edition is limited. Published in Spring annually . . . Only $3.00 to subscribers.

WIRE & WIRE PRODUCTS

300 MAIN STREET STAMFORD, CONN.

Outstanding Personalities of the Wire Industry

The Glenn L. Martin Co. Announces Appointment of A. W. Fuhrman

APPOINTMENT of **Albert W. Fuhrman** as research chemist in the Chemicals Division's laboratories of **The Glenn L. Martin Company** has been announced.

* * *

DR. Fuhrman is a recent Ph. D. in chemistry from Purdue University, where he was an American Chemical Society Predoctoral Fellow. He served in the Navy with the rank of Lieutenant (jg).

* * *

DR. Fuhrman will assist in continuing research in the vinyls and allied fields. The Glenn L. Martin Company's chemicals plant, producing Marvinol VR-10 polyvinyl chloride type resin, is at Painesville, Ohio, and Division offices and laboratory are at 501 Preston Street, Baltimore, Maryland.

Nopco Transfers Connell to West Coast

TRANSFER of **Joseph E. Connell** from the New England territory to the West Coast has just been announced by **Nopco Chemical Company**, Harrison, New Jersey.

* * *

MRr. Connell has been with the Company for more than 12 years and has wide experience with company products and their application. Prior to acting as sales representative for the company in New England, he served in both the home and Boston offices.

* * *

MR. Connell's new territory will include Washington, Oregon and Northern California where he will be responsible for sales on the company's line of Industrial processing chemicals and the metallic soaps of its subsidiary, Metasap Chemical Company. Effective date of the transfer is September 1.

Standard Varnish Appoints Eldot

THE **Standard Varnish Works** (Trade Sales Division) and its subsidiary, **Toch Brothers, Inc.** ("R. I.W.") of New York and Chicago, announce the appointment of **Leon D. Eldot** as Coordinator of Marketing and Sales Development for both companies.

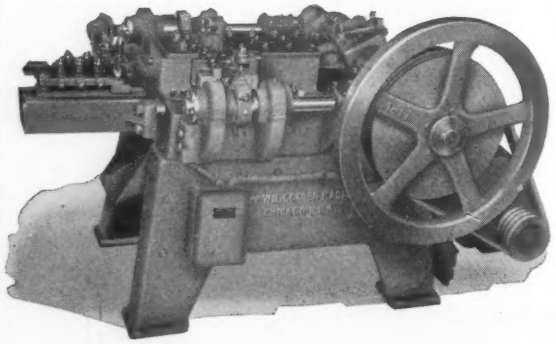
* * *

HE will be associated in these activities, with Mr. **W. M. Seidel**, Manager of the Eastern Division and Mr. **L. H. Jenkins**, Manager of the Western Division.

* * *

AN integrated marketing and sales program is being projected which will expand the operations of these two companies and provide increased services in the fields in which their products are used and distributed.

GLADER HIGH SPEED WIRE NAIL MACHINE



MACHINE ARRANGED FOR INDIVIDUAL MOTOR DRIVE

High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS
210 No. Racine Ave.
Chicago 7, Illinois
Export Dept.: 122 E. 42nd Street, New York 17, N. Y.

MR. Eldot was formerly associated with L. Sonneborn Sons, Inc., as Manager of its Building Products and Paint Division; is a Past President of the New York Paint, Varnish & Lacquer Association, and is now on the President's Advisory Committee; he has been very active in the industry, having served on many committees, cooperating with the Paint Travellers Association, Retail Paint Dealers, and in lecturing at New York University in connection with the course on paint retailing and merchandising; is a member of the Advertising Club of New York City, Sales Executives Club National Federation of Sales Executives, American Marketing Association and American Arbitration Association.

Monorail Association Elects New Officers

MONORAIL Manufacturers Association, New York City, announces the election of **E. J. G. Phillips,** Director of Engineering for Richards Wilcox Manufacturing Company, Aurora, Illinois, as president and **A. F. Anjeskey,** Sales Manager of Cleveland Tramrail Division of The Cleveland Crane & Engineering Company, Wickliffe, Ohio, as vice president. **E. Donald Tolles** was re-elected as secretary.

A. F. Anjeskey, Sales Manager, Cleveland-Tramrail Div., Cleveland Crane & Eng'g Co., Wickliffe, Ohio.

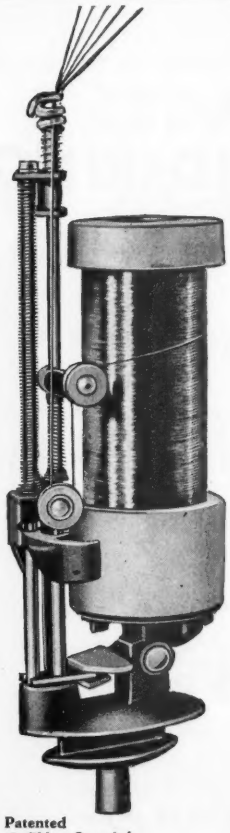
* * *

Paul Queneau Named Metallurgical Engineer of International Nickel

PAUL **Queneau** has been appointed Metallurgical Engineer of **The International Nickel Company of Canada, Limited,** and subsidiaries.

* * *

MR. Queneau has been Superintendent of Research at International Nickel's mines and plants at Copper Cliff, Ontario, since May, 1941. In his new position his headquarters will be at New York. Joining the Company in 1934, Mr. Queneau was a member of the Technical Staff of the Company's Huntington, West Virginia, Works for three years. He was then transferred to Copper Cliff, where he was Research Engineer until his appointment as Superintendent of Research in 1941.



Patented
2 BX - Special
MOSSPEED Carrier.

MOSSPEED BRAIDER CARRIERS

FOR BRAIDING

MULTIPLE ENDS OF FINE WIRES

A special design MOSSPEED CARRIER and BOBBIN is supplied for braiding "SHIELDED" WIRE, ETC.

Will braid multiple ends of aluminum, brass, bronze or copper wire, etc.

TWO SHEAVE-WHEELS and SPECIAL-TOP-THREADEYE on carrier, together with new type BOBBIN provides an even wire "let-off" resulting in a high quality and uniform braided shield.

Consult our engineers regarding your braiding problems

MOSSBERG

Pressed Steel Corp.

18 WEST STREET

ATTLEBORO, MASSACHUSETTS, U. S. A.

European Agent

James Day (Machinery), Ltd., "Ford House," 88 Regent Street, London, W. I., England.

DURING World War II Mr. Queneau served in the U. S. Army Corps of Engineers from May, 1942, to December, 1945, being called to active duty as Second Lieutenant in the Corps of Engineers Reserves, returning to the Reserves as a Lieutenant-Colonel. He served in the following campaigns: Normandy, Northern France, Ardennes, Rhineland and Central Europe.

* * *

MR. Queneau is a graduate of the Columbia School of Mines, where he received B. A., B. Sc. and E. M. degrees. He studied at Cambridge University, England, as an Evans Fellow. Mr. Queneau is a member of the American Institute of Mining and Metallurgical Engineers, the Canadian Institute of Mining and Metallurgy, the Arctic Institute of North America and the New Jersey Society of Professional Engineers. He is a native of Philadelphia, Pennsylvania.

* * *

W. K. **Sproule** succeeds Mr. Queneau as Superintendent of Research at Copper Cliff. He was formerly Chief Physicist of the Company's Copper Cliff Research Laboratory. A native of Montreal, he is a graduate of McGill University.

Raymond G. Schiele Appointed Buyer for General Electric R. and I. M. Division

APPOINTMENT of **Raymond G. Schiele** as buyer for the General Electric Company's Resin and Insulation Materials Division has been announced by J. C. Morris, division superintendent.

* * *

MR. Schiele has been with the General Electric Company since 1937 and before coming to the Resin and Insulation Materials Division was a buyer in the Purchasing Department of the Company's General Office. He has also had seven years experience with the Wayne Merriam Company of Schenectady.

Nopco Adds Gavin to Staff

WILLIAM J. Gavin has been appointed a member of the New England sales force for the Industrial Division of **Nopco Chemical Company** and for its subsidiary Metasap Chemical Company according to a recent announcement from the home offices at Harrison, New Jersey.

* * *

PRIOR to his appointment, Mr. Gavin was associated with the Company at its Cedartown, Georgia, plant where he had wide experience in the manufacture, control and application of company products which include a complete line of processing chemicals and metallic soaps. In New England, he succeeds Joseph E. Connell, and will work directly under Harold J. Waldren, District Manager. His territory will include Northwestern Massachusetts, Maine and Eastern New Hampshire.

ADVANTAGES WORTH CONSIDERING

When in the market for cable lacquers, insulating finishes, or impregnating compounds, consult us and have at your command:

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Our Hot Melt, *Flame Resistant, Non-Toxic* Compounds are most widely used for AF and CF wires.
Your inquiry is invited.

STANDARD VARNISH WORKS

Engineers of Product Finishes

NEW YORK — LINDEN, N. J. — CHICAGO

Serving Industry For 77 Years

Roger M. Scott Joins Morgan Construction Company

ROGER M. Scott, formerly Chief Engineer of the New England Butt Company, Providence, R. I., has joined the **Morgan Construction Company,** Worcester, Mass., as an engineer in the Wire Machinery Department.

* * *

MR. Scott is well and widely known throughout wire circles and his many friends will be glad to learn of his affiliation with Morgan and wish him the fullest measure of success.

* * *

THE Morgan Construction Company is also to be congratulated on securing the services of so fine a man as Mr. Scott, whose ability will contribute to their service to the wire industry.

J. E. Crotty Appointment

THE **Aetna-Standard Engineering Company** of Youngstown, Ohio, announces the appointment of **J. E. Crotty** as Sales Engineer for their Wire Drawing Equipment.

* * *

MR. Crotty attended Ohio University and was afterward employed by the W. S. Tyler Company, Cleveland, Ohio, for three years in the screening machine engineering department. He was with the Trauwood Engineering Company from 1939 to 1946 designing and engineering wire heat treating and processing equipment. Between 1946 and 1948 he was manager of the wire department for Manganese Steel Forge Company, Philadelphia, Pennsylvania.

J. E. Crotty, Sales Engr. Wire Drawing Equip., Aetna-Standard Engineering Corp., Wickliffe, Ohio. * * * *

Dr. R. F. Mehl Appointment

APPOINTMENT of Dr. **Robert F. Mehl,** Carnegie Institute of Technology, to the advisory committee to the Secretary of Commerce on the National Bureau of Standards has been made by Secretary of Commerce Charles Sawyer.

* * *

DR. Mehl, Director of the Metals Research Laboratory at Carnegie Tech, recently returned from Europe where he delivered the Hatfield Memorial Lecture in London, England. He also addressed the Swedish Metallographers' Society and the Royal Institute of Technology in Stockholm, Sweden.

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HMT
ESTABLISHED HUGHESVILLE MACHINE & TOOL COMPANY 1846
WIRE & PROCESS MACHINERY

Standard and Special Equipment for the Wire Industry

STRANDERS • SCRAP BALERS • STRAIGHTENERS
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Hughesville, Pa.
Phone 129A

Thomas S. Hughes
35 Admiral Road
Toronto 5, Ontario, Canada
Phone—Kingsdale 3356

J. E. N. Hume Retires

JOHN E. N. Hume, Commercial Vice President of the **General Electric Company,** has retired from the company after 41 years' service, it has been announced by Charles E. Wilson, G-E president.

* * *

MR. Hume is widely known in the mining and steel industries and for many years has been a key figure in mine and steel mill electrification.

* * *

BORN near Alexandria, Va., Mr. Hume was graduated from the University of Virginia in 1906 with a B.S. degree in electrical engineering. The following year he joined General Electric on the Test Course at Schenectady, and after completing the course entered the switchboard engineering department. In 1911 he was transferred to the Baltimore office as a salesman, and returned to Schenectady the following year in the Industrial Department. Later he became manager of sales of the mining and steel section of that department.

* * *

IN 1928 Mr. Hume became manager of the motor division and in the following year assistant manager of the entire Industrial Department. After being named manager of the department in 1935, he was elected a commercial vice president of the company in 1938.

* * *

MR Hume is a member of the Association of Iron and Steel Engineers, the American Iron and Steel Institute, and the National Electric Manufacturers Association. He is a Director of the Trumbull Electric Manufacturing Company of Plainville, Conn., the General Electric Supply Corporation of Bridgeport, Conn., and the Mahoning Valley Steel Company of Niles, Ohio.

Lehmann and Gibson Get G-E Appointments

DR. Zay Jeffries, vice-president of the **General Electric Company,** has announced the appointment of **George P. Lehmann** to his personal staff with duties as assigned, and the appointment of **Robert L. Gibson** to succeed him as manager of the Company's Plastics Division which has plants in Meriden, Conn., Coshocton, O., and Decatur, Illinois.

* * *

MR. Lehmann, who has been Plastics Division manager since January 1947 has been with the General Electric Company since 1935, first as a student engineer and then as a member of the high voltage laboratory of the Pittsfield Apparatus Works. He came to the Plastics Division in 1939 as assistant to the chief engineer of the division, and in October 1940 transferred to the Company's Meriden, Conn. Works as plant engineer. A Colonel in the XIIth air force during the war, Mr. Lehmann returned to the Plastics Diviison in 1946 to take the post of assistant division manager.

* * *

MR. Gibson who was manager of the Chemical Department's Personnel Division as well as the Advertising and Sales Promotion Division has been with the General Electric Company since his graduation from college. He was assistant to **Robert S. Peare,** vice-president in charge of advertising and publicity for the General Electric Company, before being appointed advertising and sales promotion manager of the Chemical Department when it was formed in 1945.

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A Review of Recent Wire Patents

No. 2,444,523, APPARATUS FOR SURFACE CONDITIONING WIRES AND THE LIKE, patented July 6, 1948 by Norman H. Nye, Cuyahoga Falls, and Walter E. Rogers, Stow, Ohio, assignors to The Vaughn Machinery Company, Cuyahoga Falls, Ohio, a corporation of Ohio.

This patent, containing 10 claims, is described as improvement upon the invention described in Patent No. 2,355,174, dated Aug. 8, 1944. The present invention included improved devices for oscillating the traveling wire strand while in contact with suitable mechanical surface-conditioning devices.

* * *

No. 2,444,639, PROJECTION METHOD FOR MEASURING THE INNER CONTOURS OF WIRE DRAWING DIES, patented July 6, 1948 by Flint C. Elder, Cleveland Heights, Ohio, assignor to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

The method is particularly adapted for measuring (optically) the entrance angle or angle of taper of the smoothing-out section of the die hole of the wire-drawing die.

* * *

No. 2,445,109, COIL WINDER, patented July 13, 1948 by Andrew W. Ferguson, Great Neck, N. Y., assignor to Ford Instrument Company, Inc., Long Island City, N. Y., a corporation of New York.

For winding distributed field or armature coils for electric motors and generators, the machine is adapted to wind them in a number of connected sections, the number of sections in each group and the number of turns per section being controlled, it is stated, by a relatively simple adjustment.

* * *

No. 2,445,375, SPRING STRUCTURE FOR MATTRESS, CUSHIONS, OR THE LIKE, patented July 20, 1948 by Lionel Selby Wallis, Knowle, England.

This assembly comprises a number of helical springs, a clip plate underlying the terminal turns of two adjacent springs having arches extending upwardly from one side of the clip between which pass these terminal turns, a wire underlying the clip having an arched portion extending through an opening in the clip and between the arches of the clip and also between and in contact with the terminal turns to separate the turns, and a retaining device extending through the arches of the clip and through the arch in the wire to prevent separation of the clip from the adjacent springs and to prevent separation of the wire in one direction from the clip.

* * *

No. 2,445,615, WIRE STRAIGHTENER OR SHAPER, patented July 20, 1948 by GUNARD FORSAM WORCESTER, MASS., assignor to Johnson Steel & Wire Company, Inc., Worcester, Mass., a corporation of Massachusetts.

In this shaper, each individual roll constitutes the outer race of a ball bearing, with the inner race being so mounted that it is held against turning.

* * *

No. 2,445,937, COIL WINDING MACHINE, patented July 27, 1948 by David E. Carpenter, Springfield, Mass., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania.

This machine is especially adapted to winding wire coils into the slots of electric machine cores and a desired number of angularly displaced windings or coil may be produced, with the machine performing automatically the indexing operation and reversal of winding direction required for providing an electric machine with a number of poles of alternating different polarity.

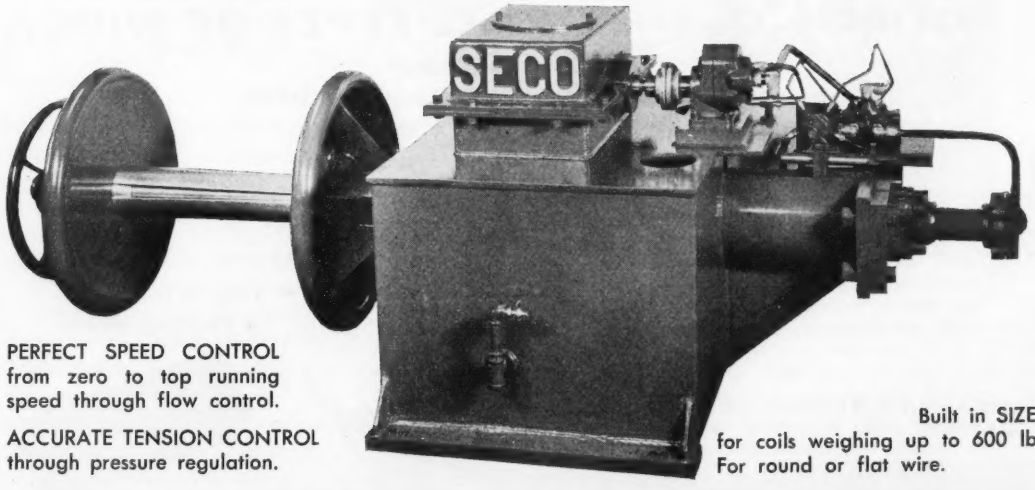
* * *

No. 2,446,050, INNER TUBE TESTER, patented July 27, 1948 by Andrew Kubin, Westlake, Charles Kubin, North Olmsted,

Complete Description and Drawings of Patents May Be Had for 50 cents, outside the United States and Canada $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

TRAVERSE REELS *Hydraulically* OPERATED

WIRE SPOOLERS, Single & Multiple Type



PERFECT SPEED CONTROL from zero to top running speed through flow control.

ACCURATE TENSION CONTROL through pressure regulation.

Built in SIZES for coils weighing up to 600 lbs. For round or flat wire.

STEEL EQUIPMENT COMPANY

2890 East 83rd Street F. JULES KELLER, *President* Cleveland 4, Ohio

and Andrew Brondos, Jr., Lakewood, Ohio, assignors to The Reliable Spring & Wire Forms Company, Cleveland, Ohio, a corporation of Ohio.

A testing cage is provided comprising two laterally spaced rings and a series of circumferentially spaced resilient wire loops having open bases supported at their ends on these rings, each loop comprising a single piece of wire having each of its ends coiled helically to provide an elongated tubular ring-receiving end portion disposed normal to the plane of the loop and the tubular end portions abutting end to end on the rings to uniformly space the loops circumferentially of the cage.

* * *

No. 2,446,058, WIRE DRAWING BLOCK, patented July 27, 1948 by Stephen J. Pachl, New Haven, Conn.

In this block, the stripper pins are locked in position by means of a new locking device.

P. M. Morgan, Pres. Morgan Construction Co. Appointed to Massachusetts Airport Management Board

PHILIP M. **Morgan**, president, **Morgan Construction Co.**, Worcester, has been appointed to the Massachusetts Airport Management Board.

New Mill Floor Finish Offered

SUBSTANTIAL progress in the elimination of one of the most common industrial accidents—slips and falls resulting from hazardous footing—is being accomplished by the increasing use of a new safety floor finish, Traffic-Tred, a product of the **Industrial Safety Products Division of The Watson-Standard Co.**, Pittsburgh, Pa.

* * *

TRAFFIC-TRED, the material of a thousand uses, is an abrasive floor coating which is applied like paint. It dries to a hard, rough coarse sandpaper. It works equally well on steel, wood or concrete, removing most of the danger from walking areas subject to dampness, greasiness and other slippery conditions.

* * *

DETAILED information about Traffic-Tred can be obtained from the Industrial Safety Products Division, The Watson-Standard Co., 225 Galveston Ave., Pittsburgh 30, Pennsylvania.

New Bulletin on Stress-Strain Recorders

BULLETIN 262, a new 32-page catalog of Baldwin stress-strain recorders and strain followers, is announced by **The Baldwin Locomotive Works**, Testing Equipment Department, Philadelphia 42, Pa.

* * *

THE bulletin describes, with pictures and diagrams, the basic principles of the various types of Baldwin recorders; gives the distinguishing features of 24 different recorders for all common makes of testing machines; and describes more than 50 extensometers, compressometers and teflectometers that can be used with the recorders.

* * *

THE bulletin also shows typical stress-strain curves as produced by recorders, includes common testing accesories, and four types of strain gages.

The **SPECIALISTS** in
Wire-Straightening and Wire-Cutting!

Diameter Range — 1/16" to .005"

PRECISION - Our Motto

DON'T hesitate to call on us when you are confronted with wire-straightening problems involving close tolerances and absolute accuracy. For seventeen years we have specialized in straightening and cutting all gauges of fine wire, hard or soft, ranging in diameter from one-sixteenth of an inch down to five-thousandths of an inch. We employ gun-barrel accuracy in straightening lengths from one inch to ten feet or any fractional part thereof. Ends cut absolutely clean without burrs.

ASK ABOUT OUR UNEXCELLED FACILITIES FOR CLEANING AND POINTING WIRE ALREADY STRAIGHTENED AND CUT.

ALL TYPES OF WIRE...

- Nickel
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Rex Multi-Welder — 7000 Welds Per Minute

THE latest model of the Rex Multi-Welding Machines was specially designed.

* * *

THE overall welding width is 112″. The machine is equipped with two slitters and two trimmers and while various widths of finished fabric can be secured, it is set for three finished rolls 36″ wide. The Welder has a range of from 18 gauge W.&M. to 12 gauge W.&M.

* * *

THE Welding Heads or Transformers are so arranged that spacings of 1″ x 1″ and larger can be secured with a minimum of change. The longitudinal wire can be increased by increments of ½″, thus; 1½″, 2″, 2½″, 3″, etc. The transverse wire can be increased by increments of 1″, 2″, 3″, 4″, etc.

* * *

THE Welder is equipped with fifty-six, 10 KVA, 440 Volt, water cooled Transformers. Each has its own individual heat control switch with three tap settings, permitting separate heat settings on individual Transformers as required. The heat is further controlled by three Westinghouse Synchronous Panels which include phase shift heat control. Each separate control is tied in to one of the three phases so that, generally speaking, the three panels balance on the three phases of the power supply.

* * *

THE Welder is operated by means of a 15 H.P. motor and actual welding speed is better than sixty welds per minute so that the average production of finished mat is approximately forty-five sq. ft. per minute on 1″ x 1″ mesh with corresponding increase in production on the larger meshes. Approximate speed is 7,000 welds per minute.

* * *

THE transverse wire is fed through a wire straightener feed mechanism into a rotary magazine which is totally enclosed. The wire is cut to length before leaving the machine and when ejected, has only a 1″ overhang on each side which can be removed by the trimmer after the weld has taken place. If short stay wires enter the magazine, the Welder automatically stops.

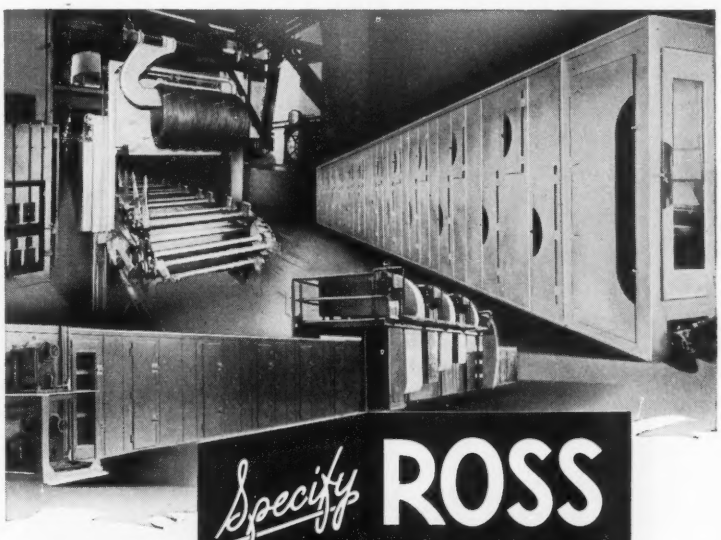
* * *

THERE is a double feed roll controlled by two overrunning clutches for feeding transverse wire. The wind-up or baler has an individual friction drive which maintains a constant tension. It has a 7″ collapsible core which, when collapsed, is 6″ in diameter. When the desired length has been run, the shaft is collapsed, making it easy to remove the finished rolls.

THE overall dimensions of the machine are 19′ x 15′. Floor space required would be 15′ x 20′ including spacing between the machine and the baler.

* * *

THE Multi-Welding Machine can be operated by one man with one reel man to handle the feed and is controlled entirely from one central panel by a series of push buttons mounted where the operator has full view of the welding operations.



Specify ROSS WIRE *and* ROD OVENS

Ross Wire and Welding Rod Baking Equipment is operating in plants of Alloy Rods Co., Arcrods Corp., Gilbert & Bennett Mfg. Co., Harnischfeger Corporation, International Nickel, McKay Co., Metal & Thermit, A. O. Smith Corp., Westinghouse Electric and others.

For drying the coatings on steel and alloy rods or for baking lime coating on wire, ROSS equipment provides design refinements and operating advantages that greatly increase output of better finished products. This accounts for their use in the leading plants throughout the industry. Write to our office nearest you for complete details.

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"Molybdenum: Steels, Irons, Alloys"

By R. S. Archer, J. Z. Briggs and C. M. Loeb, Jr.

THE varied applications of molybdenum as an alloying element are described in this book, which covers a wide range of materials from wrought to cast steels and from cast iron to non-ferrous alloys. The major emphasis has been placed on the presentation of the fundamentals that must guide all engineers, designers and metallurgists in their selection of the most suitable materials for a given application.

* * *

IN the past, many books have been confined to the presentation of uncorrelated data on specific compositions, each of which has been treated as a self-sufficient entity. Yet, as every practical man knows, many of these are interchangeable within certain limits. In the present book, an attempt has been made to show the fields of similarity and dissimilarity of the various materials and to indicate some of the factors that may affect the choice of the most economical material for a specific part.

* * *

THE scope of the book is illustrated by the main section headings: Technical Effects of Molybdenum, Fundamental Effects of Heat Treatment on Microstructure, Addition of Molybdenum, Wrought Alloy Engineering Steels, Wrought Corrosion Resistant Steels, Wrought Steels for Elevated Temperature Service, Tool Steels, Steel Castings, Cast Iron, Special Purpose and Non-ferrous Alloys.

* * *

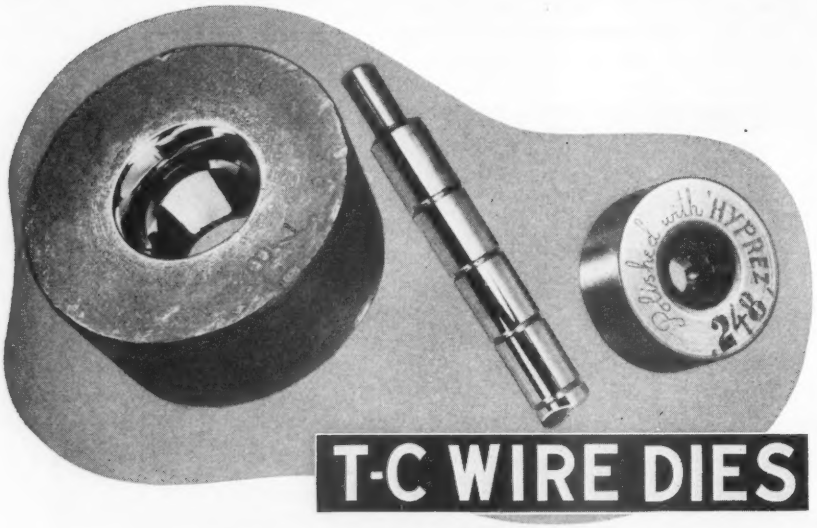
CONSIDERABLE recent information is included, not only on the more prominent developments, such as the gas turbine steels and alloys; but also on the work that has served to clarify the factors affecting the service life of the lower alloy steels. The references to current literature are adequate to facilitate further reading by anyone who desires more detailed data.

* * *

A valuable addition is the compilation of much rather obscure, hard-to-find information on some of the specialty applications, such as: exhaust valves, elevated temperature springs, ferritic gas turbine steels, high permeability alloys, contact materials, grid wires, and prosthetic alloys. The appendices include data on standard compositions of American, British and French engineering steels, working stresses from the Boiler Code, conversion tables, and the physical properties of metallic molybdenum. Published July 1948 by Climax Molybdenum Company, 500 Fifth Avenue, New York, N. Y. Metallurgists and others closely connected with metallurgical problems may obtain a copy by writing the company direct.

New Procedure Developed for Designing Springs

A new method of designing certain kinds of machine springs has been developed by **Curt I. Johnson** of Vestal, assistant engineer of International Business Machines' Research and Engineering Laboratory in Endicott.



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Hyprez produces a perfect, lasting polish on Tungsten-carbide Dies, Tools, and Wear Parts — quickly, economically.

Precision-graded, clean, virgin diamond powders, accurately graded and fast cutting, are uniformly suspended in a patented compound base; will not fly off tool or die; stable and uniform at all normal temperatures.

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Supplied in fully color-identified dust-proof cartridges and sturdy applicator or in substantial container for conventional use, if preferred.

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THE procedure applies to extension and compression springs which are dynamically loaded — that is, put into a machine which extends or compresses them.

* * *

OFTEN, in an effort to make machines compact, space for springs is limited. It is necessary to design these springs so they function correctly with a minimum of stress to the material.

* * *

WHAT Mr. Johnson has done is set up a new procedure for solving spring problems. The formulas derived from this procedure eliminate much of the mathematical calculation previously necessary in designing springs.

New Series of Technical Bulletins On Dial Scale Applications Throughout Industry Offered by Yale & Towne

SIX new 3-color technical bulletins — totaling 68 pages of data, diagrams, selection advice, and practical application information on dial scales — have just been published by the **Yale & Towne Mfg. Co.**, Philadelphia Division, and are offered without charge to production managers, traffic men and others throughout industry who rely on highspeed accurate weighing to measure and control the flow of goods. One of the most important bulletins in the series is devoted wholly to the subject of **counting** scales — equipped with ration pans to adapt the scale to precise indication of numbers of parts handled in bulk. Two of the brochures are devoted to **bench** scales and **portable platform** scales, respectively — possibly the most widely used types. Another describes the **dormant platform** scale line — those scales with platforms flush with (and actually a part of) the plant floor surface, and designed principally for weighing loads carried on trucks. The fifth bulletin is specialized to **crane** scales, that type designed to be used in conjunction with cable or chain hoisting to save needless picking-up and setting-down. The last is designed for the dairy industry and discusses the special characteristics of **weigh-can** installations.

* * *

COPIES may be obtained from R. F. Miller, The Yale & Towne Mfg. Co., 4530 Tacony Street, Philadelphia 24, Pa.

Bristol Develops Proportioning Pyrometer Controller

THE development of a proportional current-input electronic pyrometer controller has been announced by **The Bristol Company**, Waterbury 91, Conn. The new instrument proportions the current input to electrically-heated furnaces, ovens, plastic molding machines, salt pots, and other similar equipment to provide practically straight-line temperature control. It does this by time modulation of the input energy. The average energy supplied is proportional to the deviation of the temperature from the control point throughout a band width, which is adjustable from 0 to 2½ percent of full scale reading. The instrument, Model IE486, is described in Bulletin PB1237.

WIRE WEAVING LOOMS FOR INDUSTRIAL WIRE CLOTH

FLY SHUTTLE LOOMS

Offers many important new features

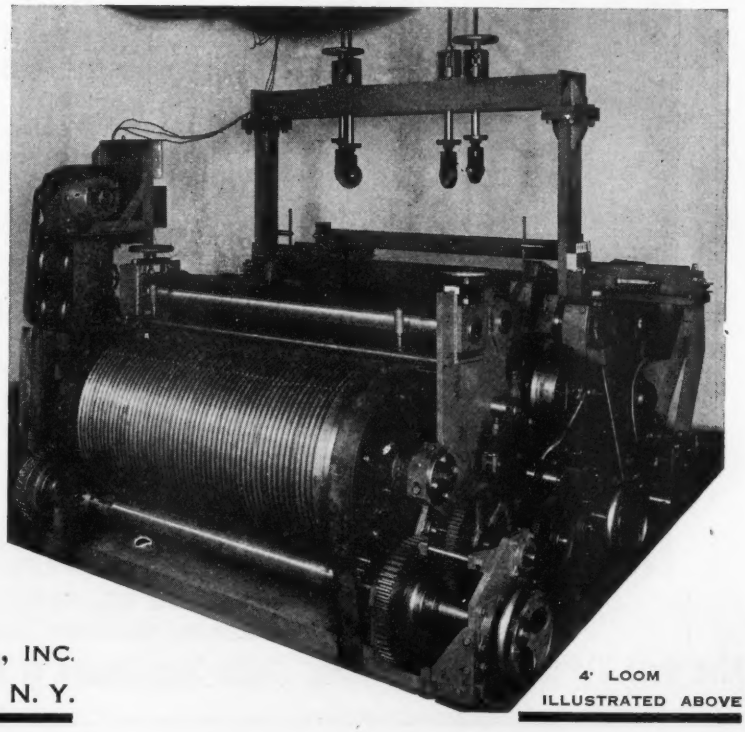
All steel welded construction for rigidity and long satisfactory service.

Precision in workmanship, operation and production.

Built in

Standard Models 3′, 4′, 6′, 8′, 10′, 14′ or to your special specification.

Years of rigorous field service have demonstrated their superiority.



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Conditions in the Pickling Bath Which Effect Hydrogen Embrittlement

(*Continued from page 761*)

within the limits of measurement —beyond that caused by pickling in raw acid (See Figure 18). The same is true for Reagent V (not plotted), and Reagent VI. (See Figure 19). However, Reagent VI is a wetting agent, not an inhibitor. Since it is a surface active agent and is sometimes added to pickling baths, its behavior seemed worth determining; but there was no effect.

Quinoline Ethiodide

BY means of this preliminary study of representative commercial pickling inhibitors, we have now discovered — at least for the pickling of Type 440-C stainless steel — **that in no case yet studied does the inhibitor improve embrittlement above that occurring in raw acid,** and regardless of vast differences in metal attack.

FURTHERMORE, two or three of the most popular inhibitors greatly increase embrittlement, and consequently any other defection that follows from hydrogen absorption, such as blistering, poor adherence, and so forth. Also, the behavior of the inhibitors is suggestive of the behavior of arsenic, in greatly aggravating embrittlement with the first small additions, and then reversing that effect with further additions.

* * *

HOWEVER, the inhibitors differ from arsenic in that the reversal with the commercial inhibitor either dies out rapidly in its effect, or reverses again to cause further increase in embrittlement. In no case yet studied does the curve carry back even to the angle of embrittlement for raw acid, let alone the 180° bend which the specimen should sustain if the inhibitor inhibited hydrogen absorption.

* * *

FREQUENTLY mentioned as an excellent inhibitor, though too expensive for general use, is quinoline ethiodide. Because one is dealing with undefined chemicals in commercial inhibitors, it seemed advisable to test this inhibitor whose constitution is well known.

* * *

TRUE to claim, quinoline ethiodide is an inhibitor in all senses of the word. (See Figure 20.) However, concentration must be closely specified because this chemical, exactly like arsenic and the injurious commercial reagents, causes an initial drop in bend with small additions. Unlike the commercial reagents, but like arsenic, quinoline ethiodide then reverses its effect; and the bend value continues its upward limits until a complete 180° bend is attained.

Conclusion

FACTORS affecting the hydrogen embrittlement of steel wire during acid pickling are investigated in this paper by means of the constant-rate single-bend test, and the

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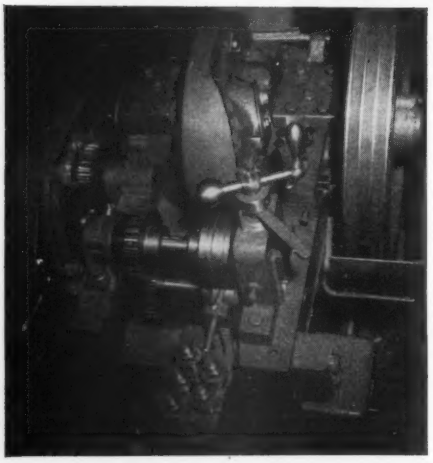

Top View, showing Fly Wheel and Gears

FENCE STAPLES — POULTRY NETTING STAPLES — DOUBLE POINTED TACKS (WIRE CLOTH TACKS)

Fastest Staple Cutter Ever Made — Makes Two Complete Staples at each revolution — Compact, Easily Adjustable, Efficient.

48 Different Leg Lengths, Gauges 9 through 18

Can Be Made With

HUMPHREY RAPID STAPLE CUTTER

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Also Bale Tie Machines, producing single loop, round or oval ties, 2000 per hour; 3 to 16 ft.

UMI

following generalizations can be drawn:

1. **The highly ionized acids, H_2SO_4, HCl and HF, cause comparable embrittlement for comparable concentrations;**
2. **Acids of lesser ionization, such as H_3PO_4 and CH_3COOH in particular, ionize so slightly that little or no embrittlement results;**
3. **In the embrittling range of concentrations, however, all acids cause similar injury;**
4. **At very high concentrations, H_2SO_4 and CH_3COOH in particular ionize so slightly that little or no embrittlement results;**
5. **Increasing the temperature of the pickling solution increases hydrogen embrittlement, other factors being constant;**
6. **Sulfur, which may enter the bath through the leaching of sulfur-containing steels, aggravates embrittlement and may account for the fact that hydrogen-caused defects can occasionally be traced back to the use of old pickling solutions;**
7. **Arsenic in small quantities also aggravates embrittlement; but, unlike its action in cathodic pickling, further quantities of arsenic in acid pickling inhibit hydrogen embrittlement with such great effectiveness that arsenic becomes a true inhibitor;**
8. **Quinoline Ethiodide, a more expensive product, behaves like arsenic;**
9. **Of five popular commercial pickling inhibitors tested, using Type 440-C stainless steel as specimens, none lessened embrittlement beyond that of the new acid, and some greatly aggravated it.**

* * *

WHILE the specific behavior of inhibitors remains to be disclosed for mild steel, with which these reagents are principally concerned, they are commonly believed to inhibit or to prevent hydrogen embrittlement wherever they definitely decrease acid attack: and they are added to pickling baths with regard to characteristics of the acid, not of the metal. The present research discloses that this common belief is in error for the pickling of stainless steel to a point of being contrary to fact.

* * *

BECAUSE of the marked practical importance of the discovery, special studies will be reported at the Fall meeting of the Wire Association exploring in detail the behavior of commercial pickling inhibitors in the pickling of both stainless steel and carbon steel, and disclosing a new reagent developed in conjunction with the technicians of the American Chemical Paint Company which inhibits both metal attack and hydrogen embrittlement.

Acknowledgment

ACKNOWLEDGMENT is due the American Society for Metals and the American Institute for Mining and Metallurgical Engineers in whose publications much of the present material originally appeared, also the Office of Naval Research whose sponsorship of a fundamental study of gas-metal reactions in this laboratory has allowed development of the concepts reported in this paper.

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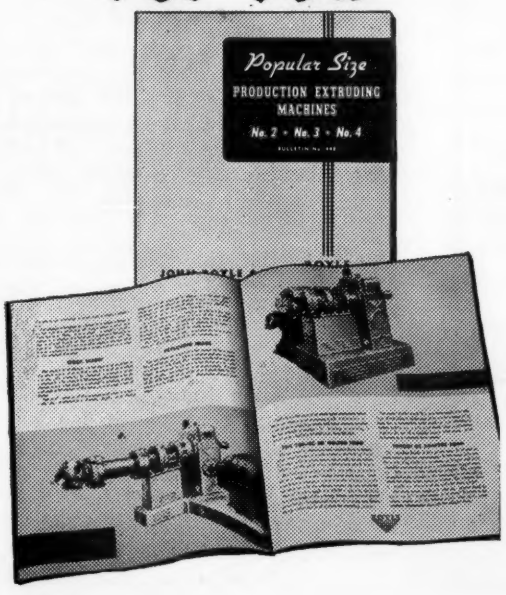

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History and Progress of Wire Coatings

(*Continued from page 762*)

ABOUT seven years ago, I did some interesting research with various component parts of different lime substitutes and coating compounds. The first purpose of these tests was to eliminate those chemicals which might create to any extent a hydroscopic condition to absorb moisture leading to rust, and to find a good carrying agent for the coating which would stretch with the metal through all passes.

* * *

IN these experiments, all free alkalies were eliminated; also, rosin soap was dropped as a binder. The alkalies definitely created a hydroscopic condition, and the combination with rosin gave a very poor pickup of lubricant and was very hard on the dies. Most important, wire could not be stored for any length of time without rusting. These experiments clearly showed:

1. That a coating compound to replace lime should be of a low pH, with no free alkali, but just sufficiently on the alkaline side to take care of any traces of acidity on the rod and wire.

2. That the compound should contain a water-soluble binding and carrying agent which is very important for high-speed continuous drawing of high carbon stock. Rosins and soaps were eliminated, also wetting agents which were liable to cause rust.

3. A coating, to be ideal, would need to eliminate baking, using only a heating unit at low temperature to dry finer sizes of wire where moisture becomes trapped in between the strands.

4. A compound which would readily pick up sufficient lubricant in the first die box.

5. One which would provide sufficient cushioning and slip to give greater die life.

6. Contain a good rust inhibitor for protection, not only during processing, but in storage and transit.

* * *

AS the result of these tests, following the above points, the first successful coating compound was developed six years ago, and this was the first time in the history of wire drawing that rod and wire were successfully drawn on a full production basis without lime and without baking. The compound gave excellent die life and no rust. In the past five years, it has been used by a greater part of the wire industry on part production of special finish wire and bright wire, and today, there are, I believe, six or seven wire mills running entirely without lime and without baking.

* * *

THE borate compounds, not borates alone, have so far been the answer to successfully eliminating lime and baking, increased die life and rust protection. With this method, also, there is no hydrogen embrittlement.

* * *

AS mentioned earlier, this type of coating must have a controlled pH value in order to draw rod and wire day by day, without interruption, on full production.

* * *

REGARDING the question of cost, which invariably comes up, the cost is no higher than with lime coated wire. To the contrary, it might become lower. However, we have to take into consideration present equipment, built for old methods of drawing wire. It is natural that some changes have to be made, both in procedure and handling, and in some cases in equipment.

* * *

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IN arriving at production costs, several very obvious savings present themselves immediately. First of all, the number of men required to handle the wire by the new method is cut to one-third of that required for handling lime coated wire. Since most wire mills run on three shifts, an appreciable payroll saving is evident. Secondly, fuel cost for operating bakers is eliminated completely. Third, since with this new method the rod or wire is self-drying, the rod goes almost directly from the coating bath onto the drawing machine, doing away with many hours formerly lost in the baking operation. Finished wire output is stepped up by a large percentage. Last, but not least, the usual respiratory ills and skin eruptions suffered by men handling lime are non-existent, cutting down completely man-hours lost due to these health hazards. Other savings in lubricants, fewer rejects, etc., soon become apparent.

* * *

FROM the surveys made, the new process is making rapid progress in the wire drawing industry, and on the new high-speed machines is definitely creating faster production and a better finished product, not obtainable with lime coating.

* * *

THE new coating compound is being used so far on all types of rod and wire except spring wire and cold heading wire, although on the latter some successful tests have recently been made.

* * *

EXCEPTIONALLY good results are being obtained on coating fine wire for wet drawing, run off a dry reel. There is no need for water storage.

* * *

ALL in all, great progress has been made lately towards eliminating lime altogether, and the new coating process is making rapid headway. With practically every other industry streamlining its production methods, the wire industry now has the opportunity to speed up its production of one of the most essential products of present day living.

* * *

Above the Ears of Men
A Philosophy for the Future

(*Continued from page 772*)

* * *

WE have to recognize that he has great optimism, a great pride, and as strongly defined a sense of fair play as his employer.

* * *

WE have to understand that he is intelligent, that he is a realist, that he wants to work in a well-organized, well-run and successful establishment and that he wants to work in a friendly atmosphere.

* * *

WE have to learn that he is just as hungry for information as his employer and that the one most important thing he wants to know is that he is getting a fair share of the dividable dollar.

* * *

WE have to learn that workers are not just interested in "more pay for less work" but that their real fundamental ingrown hunger is for recognition, information, understanding, and to be regarded as members of the team.

Inquiry:

Gentlemen:-

We specialize in the manufacture of low and high carbon steel wire, and are not satisfied with the wire drawing compound we are using, especially from the standpoint of stability and die life. Can you help us?

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NOPCO EVOLVED THRU RESEARCH

WE need to concentrate on getting every man to think **well of himself.** We need to concentrate on understanding ourselves how the delicate hairspring of human relations speeds up or retards all progress.

* * *

WE need to devote ourselves to acquiring a sympathetic understanding of the other man's point of view, to working with the power of the ego of man, not against it.

* * *

I believe we are evolving this concept of human relations. If we make a conscious, sincere and continuing effort to resell an understanding of what this way of life that got us where we are is all about it is certain to accelerate this evolution.

* * *

MEN'S minds are not rigid. They are flexible and pliable. So long as we retain freedom of opportunity, there is absolutely no limit to how high we can step up the **quality** of our people by stimulating their thinking and heightening their faith, but the paralyzing rigidities of regimentation would not only end the hope of expanding the use of the boundless human energy that is stored up in our people but actually lower present levels of productivity.

* * *

FOR that reason these two jobs are irrevocably tied together but in the process of doing them we are going to automatically increase the efficiency and productiveness of our people in an astounding fashion.

* * *

NOT only that, but by adding cubit to the stature of men, by giving them a sense of belonging, by raising their sights, by restoring hope, we shall bring contentment and happiness to a people that today is an anxious rather than a happy people.

* * *

HIGH as our standard of living is, great as have been our accomplishments of the past, we can attain new heights only dimly seen if we succeed in escaping the paralyzing rigidities of regimentation and succeed at the same time in releasing just a small fraction of the unawakened and unused capabilities of the 60 million people who do the work of our country.

* * *

BUT you will agree, I'm sure, that just to know what ought to be done is no solution of the problem. A road map locked up in the glove compartment of your car will not help you arrive at your destination.

* * *

FREEDOM of the individual is based on his willingness to act as a free man. If more individuals are willing to be the ward of a state for a fancied security than are willing to stand up and slug it out for themselves, then freedom is gone. It will be shattered on the reef of political expediency.

* * *

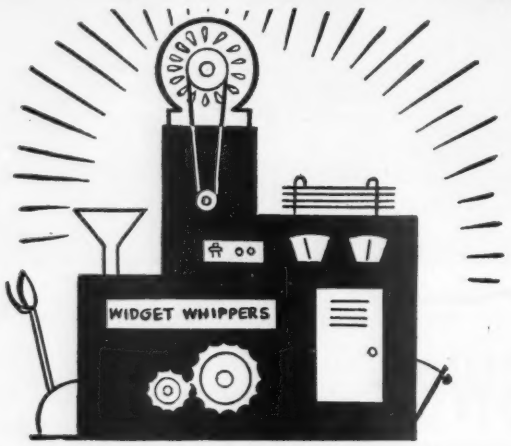
IF you believe that you **should** speak out and yet don't do it to the limit of your ability and opportunity then you are not different from the man who owns 100 acres of fertile land yet tills only 10 or 20 or 30 of them. The rest go to waste.

* * *

THERE is an old proverb that we should never forget:

"A silent sage has less influence than an articulate fool."

Whether you make Whippers



. . . or pots and pans, or trucks, or stoves, or any product fabricated of metal . . . you'll be interested in the story of Mr. Widget. He was faced with the dilemma of wanting to use resistance welding but not having sufficient plant transformer and distribution facilities to handle the extra load. Also the power people frowned on the addition of a *low power factor* load.

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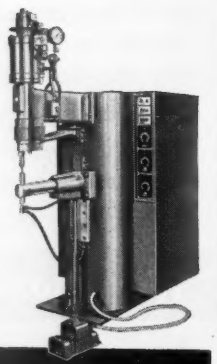

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BUT the great poet Dante was even more to the point when, more than 700 years ago, he indicted appeasers, men who dodge their moral responsibility, in these ringing words:

"The hottest places in Hell are reserved for those who, in a period of moral crisis, maintain their neutrality."

* * *

WHILE we are thinking together about the extreme importance of what goes on above the ears of men in these critical days there is one thing I'd like to make abundantly clear, and that is that I am not proposing we should undertake to teach other men what our freedom of opportunity system is all about with any idea that we are even in the slightest way superior to those we would teach.

* * *

ON the contrary, I propose that we do it because we **have failed** in the past to discharge the responsibilities of citizenship and are faced now with forever forfeiting our heritage if we fail again to do it.

* * *

WE should approach the job in a spirit of deep humility, never forgetting that the present retreat from freedom has not taken place because freedom failed, but because we failed to understand and keep inviolate the heritage of freedom won for us by so-called little men.

* * *

IT was little men, desperately seeking escape from tyranny, who braved hardship and death to set up here in a wilderness a new world dedicated to religious freedom. It was out of the belief of little men in freedom of opinion, freedom of choice, that the great institutions of America grew.

* * *

WE are the spiritual descendants of English seafarers from medieval towns and villages who learned by trial and error how to manage new and strange employments in which the penalty of failure was death, and ended by creating a new kind of society, a society based on the freedom of choice of the individual.

* * *

THAT society which was hewn out of the travail of little men of great faith and courage can be saved by little men, if we help to revitalize that faith and rekindle that zeal.

* * *

IN spite of all our mistakes, our appeasements, our retreat from freedom; in spite of the fact that we have become largely idle worshippers of empty words, we are yet the only hope for the children of men in our time.

* * *

BUT we can justify that hope only if leaders LEAD—only if managers MANAGE.

* * *

IT is our job—It is more!—It is our beholden duty as the bene-

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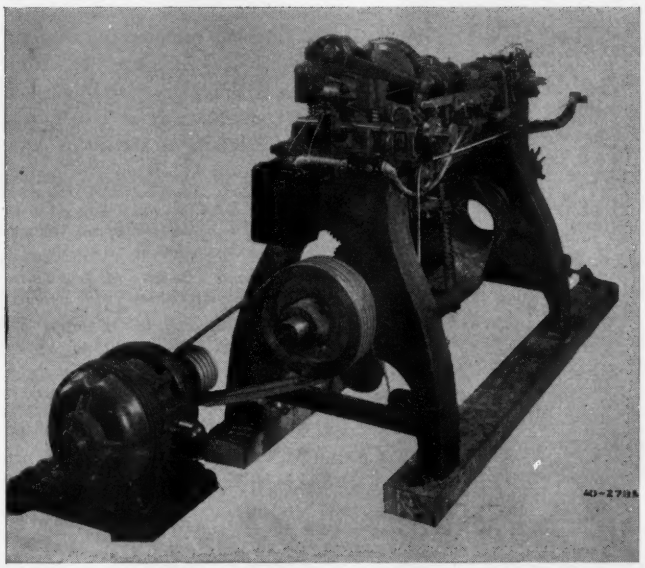

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ficiaries of the greatest heritage of freedom on this earth to carry out in our day the fundamental philosophy of the Founding Fathers which Thomas Jefferson put into these words:

> **"I know no safe depository of the ultimate powers of society but the people themselves: and if we think them not enlightened enough to exercise their control with a wholesome discretion, the remedy is not to take it from them, but to inform their discretion BY EDUCATION."**

* * *

NOTE that Jefferson said "by education"; not by disfranchising them, not by coercing them, but by stimulating their thinking. If we use the "litle grey cells" above the ears ourselves, to the point of knowing **precisely** what we believe **and why,** and then search out ways and means (and the only way it will be done, I emphasize again, is for each of us to do his share) to stimulate the thinking of all our people so that the horizons of men everywhere may be widened, the use of their inherent capabilities stepped up, their zeal rekindled, and their understandings heightened, then they will RECREATE here in America the free society we have been frittering away.

* * *

THIS spiritual rebirth of man as a responsible individual will release a force for good beyond our comprehension. The irresistible onward surge of sixty million men and women working through voluntary collectives of free men will not only meet the moral challenge of our day that we shall maintain here in America a breakwater against the rising tide of paganism behind which to preserve the souls of men, but will carry us forward to a greater destiny than any we have yet visioned—builders of a **world** where every man will know sweet freedom's way.

* * *

AMERICA was built on dreams, and if we preserve the freedom of opportunity system, IF WE KEEP MEN FREE TO DREAM, we can dream up a still more magnificent America.

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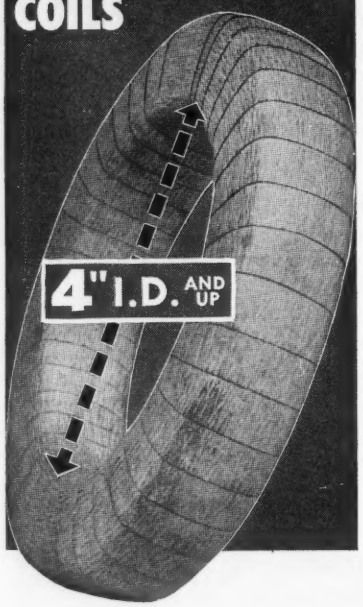

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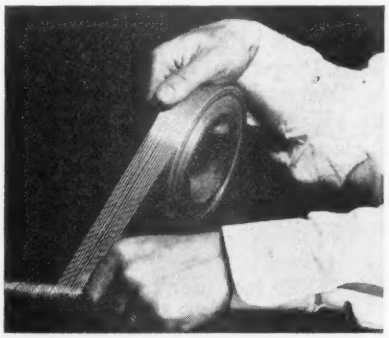
* * *

SEVERAL cable companies are incorporating this type Fiberglas-reinforced tape in power cables. The tape has been applied by standard cable taping machinery, used for the construction of multiconductor control cable, at full machine speed, and has shown marked adaptability for the intended use. Because the tape is thinner and



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stronger than commonly used treated textile tapes, less jacket material is required. Because of the higher yield of the thin tape, the cost on a square yard or coverage basis is less than that of treated textile tapes, even though the per pound price may be higher.

* * *

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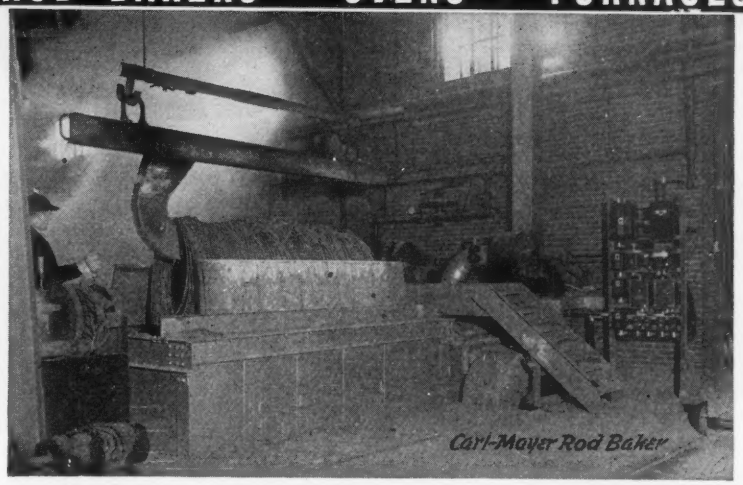

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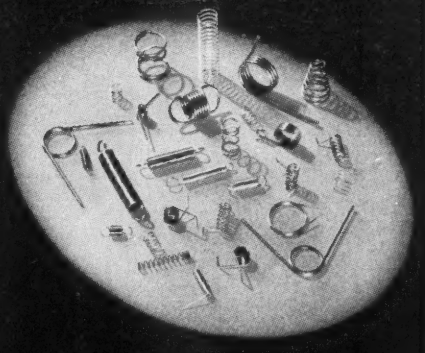

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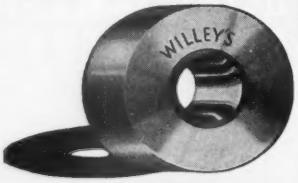

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* * *

THE tape is available in standard cable tape packages slit to widths of ¾, 1 and 1¼ inch and upward in ¼ inch increments. Other variations as to number of ends, backing, strength, and thickness can be developed.

Modern Materials Handling Shown as Key to Lower Costs in New G-E Program for Equipment Manufacturers, Power Engineers

INADEQUATE materials handling techniques are resulting in high production costs and production delays for hundreds of small and medium sized business, according to **S. W. Corbin** of General Electric's Resale Industries Division.

* * *

SPEAKING with other G-E engineers and materials handling experts at a New York City press preview for that company's new More Power to America program on "Materials Handling In Receiving, Warehousing, and Shipping", Corbin asserted that these companies often don't even know that they have a materials handling problem.

* * *

"THEY just don't realize how modern materials handling can help them cut costs, increase production, reduce inventories, and relieve manpower shortages," he said.

* * *

SPEAKING on "The Problems of Materials Handling", **J. R. Kilander**, materials handling expert of G.E.'s Apparatus Department Manufacturing Divisions, called for a major revision in present accounting procedure to reveal the true costs of materials handling.

* * *

"WHEN such systems are available, making it obvious just what it does cost to move a ton of steel from boxcar to warehouse to factory, top management will begin

to take more of an interest in materials handling," he said. " Such a system would reveal the spots where work should be done first." Kilander also recommended the delegation of competent engineers on a full time basis, to materials handling problems with full authority to put their findings into action. Increased standardization and simplification of equipment and methods was also suggested as a solution to many problems.

* * *

HE predicted the future free flow of shipping pallets between companies and areas in place of present restrictive regulations, and said that use of short-wave radio on tractor trains and trucks within large plants might do much to assure full utilization of equipment.

* * *

THE new materials handling program, thirteenth in the More Power to America series, typifies exactly the MPA philosophy of increased benefits through increased electrification and modernization, **F. W. McChesney** said at the meeting. He is a member of G.E.'s main MPA committee.

* * *

"THERE is still far too much use being made of the old "Hernia Method" of moving materials from one place to another," Mc Chesney declared. "That may have been effective thirty or forty years ago, but today, with the cost of labor what it is and the necessity of meeting tremendous production schedules, it isn't only out of date. It's bankruptcy, in many cases, not to change."

* * *

NOTWITHSTANDING the fact that electric motors furnish about 86 per cent of today's industrial horsepower, American industry is less than 50 per cent electrified in terms of jobs that electricity can do most efficiently and economically, McChesney pointed out.

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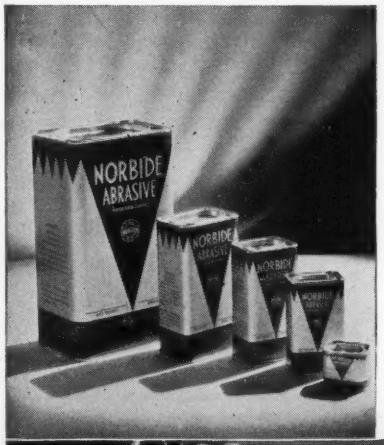

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NORBIDE Abrasive is successfully used for cutting and semi-finishing cemented carbide wire drawing dies. This abrasive is second only to diamond powder in hardness and is 150 times less expensive. Sizes 220 and 240 for ripping; 320F for semi-polishing; 500 to 800 for final finishing.

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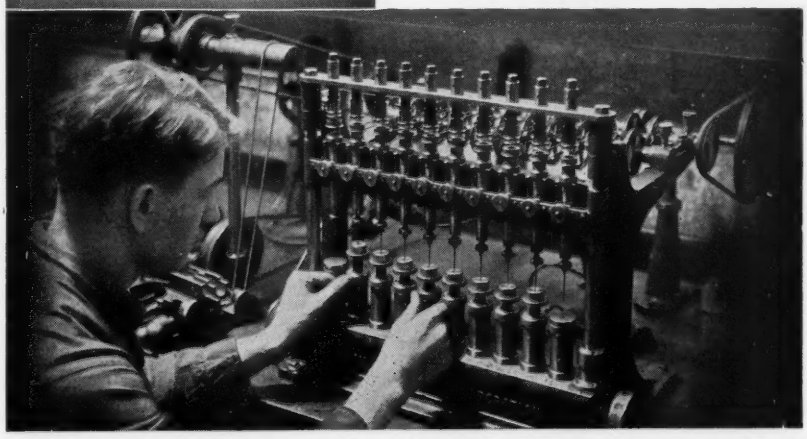

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Furnished assembled or knocked down, made to your specifications. Will withstand severest handling. Sturdy, strong, low in cost. Made for

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in any size from 12" to 96" in diameter.

ALSO, REEL HEADS FOR STEEL DRUMS

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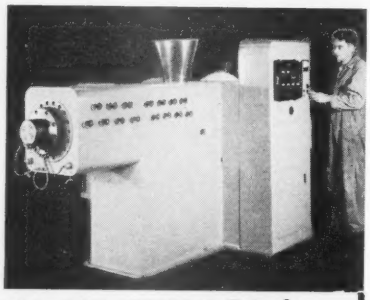

Model # 450 MODERN Extruder E-5-24-A

MODERN EXTRUDERS are not only furnished completely equipped for direct heating *but* also jacketed for oil, steam or water for fast or slow cooling.

Die heaters and controls are built in. All parts contacting plastic materials are corrosion resistant. Interchangeable heads can be supplied for covering wire, tubing, rod, strip, monofilaments and the like.

mpm

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Drives for Automatic Speed and Tension Control in Wire Processing Equipment

(*Continued from page* 768)

way operating valve, a pressure regulating valve and a pressure gauge. This arrangement results in constant torque being applied at the block, the amount being dependent on the setting of the pressure regulating valve. A torque range of about 10 to 1 is available.

* * *

ALL four hydraulic pumps are driven from the same A-C motor, and are mounted on an oil storage tank to give a compact pumping unit. Figure 22 shows an actual installation of the type just described, using four hydraulically driven blocks.

Conclusion

FROM the examples given, it is apparent that there is a close analogy between the three types of drives with reference to speed and tension control. For example, a dancer roll in a loop can be used for actuating the speed control of either an electric motor drive, a mechanical variable speed transmission, or a variable displacement hydraulic pump.

* * *

THE problem of which type of drive and control should be selected in any specific case depends on a number of factors, among which are:

1. **Range of speed or tension control required.**
2. **Degree of performance desired.**
3. **Characteristics of material being processed.**
4. **Size of drive.**
5. **Space requirements.**
6. **Auxiliary mechanical equipment required.**
7. **Power supply available.**
8. **Cost of equipment.**
9. **Delivery.**
10. **Installation expense.**
11. **Maintenance.**

* * *

IT is the function and duty of the designer to consider and carefully compare the relative advantages and disadvantages of all three types of drives in the case of each specific application.

* * *

FROM the standpoint of the machinery designer, builder and user, it is a healthy, stimulating situation to have several means available for doing the same job. Such a competitive situation is cer-

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or

STANNOUS SULPHATE

solve your tinning problems

One of these two M & T chemicals will meet all your liquor finishing or immersion plating requirements . . . whether for acid or alkaline . . . white or bronze finish baths.

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tain to bring forth improvements in both equipment and application in the electrical, mechanical, and hydraulic fields. The extended use of these systems of automatic speed and tension control in connection with wire mill machinery is certain to result in both increased production and improved quality.

Bibliography

Bundy, O. M., "Modern Electrical Control for Wire Mill Machinery". Iron and Steel Engineer, October 1947.

Gepfert, Joseph H., "Tension and Velocity Controls; Applications of the Mechanical Variable Speed Transmission." Wire and Wire Products, October 1944.

Roby, J. G., "Electrical Application in the Wire Industry." Wire and Wire Products, March 1948.

Farrel-Birmingham Issues Centennial Booklet

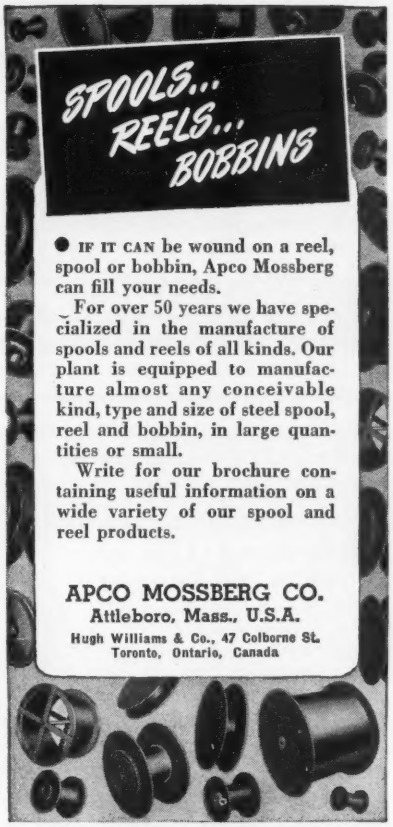
TO commemorate the 100th anniversary of the founding of its plant at Ansonia, Connecticut, **Farrel-Birmingham Company, Inc.** has released a centennial booklet which has been mailed to customers in the various industries for which the company builds heavy machinery, and also to employees, stockholders and friends of the firm.

* * *

IN six main divisions of thirty-two pages of material, the booklet strikes a nice balance in complete subject coverage and good readership. The present-day status of the company is accented, although historical data is adequate and due tribute is given to the founders and to those responsible for the early progress of both the Farrel and Birmingham interests of the company which were merged in 1927.

* * *

ON the cover a silver centennial seal, embossed on a blue background, gives the booklet impressive identification. Interest in the contents is pointed up by the liberal use of free-hand sketches of plant scenes and company products.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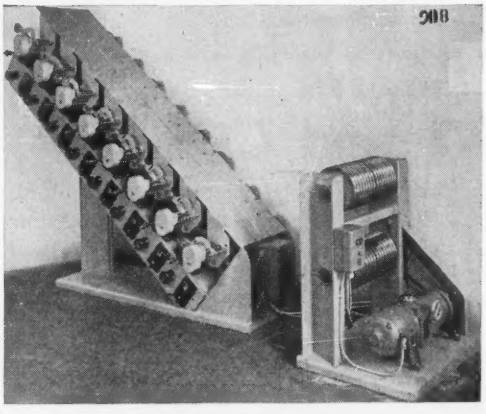
MULTIPLE WIRE PROCESSING TAKE-UP No. 908



16 units, for alloy, steel or copper wires. Each take-up spindle is individually—Ball-bearing Torque Motor powered, with wire tension controlled by rheostat. Layer wind individual unit traverses which are adjustable for rate and length of traverse.

All units collectively capstan controlled at adjustable constant speeds by ball-bearing speed reducer and variator.

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***with* Hand-Lift or Fork-Lift Trucks**

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Engineered for maximum strength and lightness
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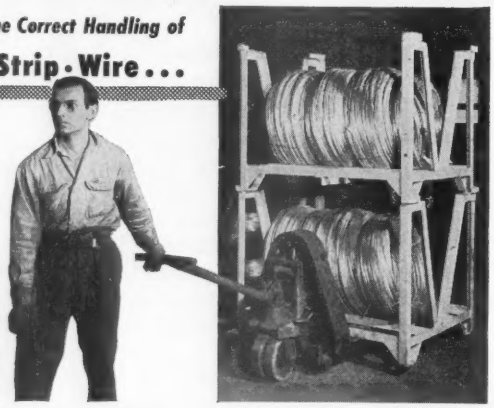

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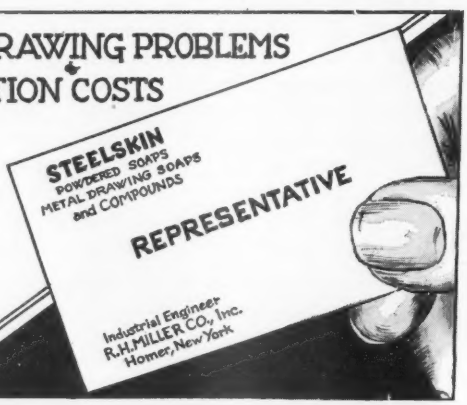

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Oakite Issues New Odor Control Booklet

THE benefits to be gained with the use of specialized cleaning, disinfecting and deodorizing materials in connection with industrial housekeeping and plant sanitation programs, are described in an illustrated, 12-page booklet just released by **Oakite Products, Inc.**, New York.

* * *

BOOKLET reports on two, specific materials that are said to perform the cleaning, disinfecting and deodorizing functions easily, efficiently and economically. Each of these materials possesses the ability to perform **diverse** activities within a single application. The first, double-action Oakite Di-Sanite, combines thorough, all-purpose cleaning action with effective deodorizing ability. The second, Oakite Tri-Sanite, a three-fold sanitizing agent, contains germicidal and fungistatic properties in addition to its odor-killing and light detergent characteristics, it is reported.

* * *

SOLUTIONS made up with these materials, the booklet states, may be applied directly to surfaces by spraying, swabbing, brushing soaking or steam gun. Only small concentrations of each material, it is said, are sufficient to supply "at-the-source" deodorization and efficient detergent action. Booklet lists many diversified applications of these materials in various types of industrial plants, gives working directions, recommended concentrations, etc. Readers wishing free copies of this new booklet may obtain them by addressing Oakite Products, Inc., 152A Thames St., New York 6, N. Y.

New Data on Recently Developed Corrosion Resisting Alloys

A new bulletin on nickel-molybdenum and nickel-molybdenum-chromium alloys introduced about two years ago by **The Duriron Co., Inc.**, has just been issued.

* * *

THIS bulletin includes much information on the new Durco alloys, Chlorimet 2 and Chlorimet

3, not previously available. Particular attention is given to its use for sulfuric acid, hydrochloric acid and salt solutions, and on how it supplements other alloys for these corrosives.

* * *

MANY charts are included on corrosion resistance tests. One hundred and twenty corrosives altogether are dealt with.

* * *

CHLORIMET 2 and Chlorimet 3 are available in cast form. Durco-pumps and valves are now regularly supplied in these alloys.

* * *

FOR full information, write to The Duriron Co., Inc., Dayton 1, Ohio, and ask for Bulletin 114.

Industrial Diamond Association Letter

(*Continued from page* 777)

seems impending, of quality diamond dies. This would be more than regrettable after the effort that has been expended throughout the past years to improve the production and raise the morale of the industry. Improved production methods and better types and qualities of diestones are what made it possible for the American diemakers to supplant most foreign dies and to stay far in the lead of other countries for war and peacetime production.

* * *

WE ask you kindly to read the subsequent letters in this series which is being published in your interest by **Wire and Wire Products.** You will find that while the service has been inspired by the plight of the diamond die segment of the industry, your industry stands to gain equally by knowing the facts as they exist.

* * *

IN a following letter, the Association will call attention to some of the practices by which the die rooms reduce diamond die unit costs, but in so doing tend to cause the producer to reduce the quality of his diamond dies. From such dies there would be a more than proportionate reduction in the quantity and quality of wire produced. This, although so small a percentage of wire costs is chargeable to diamond dies — that is, when the dies are as good as they should be.

Phone 2-3043

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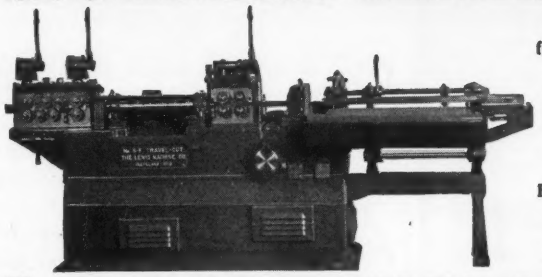

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New Line of Tri-Clad High Speed Synchronous Motors and Generators Announced by General Electric

A new line of general purpose, TRI-CLAD, high speed synchronous motors and generators in "900 series" frame sizes, has been announced by the Large Motors and Generators Divisions of the **General Electric Company.**

* * *

THE new motors are available in standard ratings from 20-hp to 1,000-hp at 60 cycle speeds of 514 to 1800 rpm, in either two-phase or three-phase types. Generators are available in ratings from 12½ to 1250 KVA.

* * *

OF drip proof construction, the motors incorporate the usual TRI-CLAD features. Direct-connected and belt-driven exciters are available for all ratings.

* * *

ADDITIONAL information available in GEA-5113 and GEA-5125.

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After pickling, BORAX can be applied with one dip; dries in three minutes in an oven temperature of 150° F. to provide a coating that will not check or flake off in storage. Dissolves readily in water and is dust free. BORAX, other than being an excellent vehicle for picking up the drawing lubricant, is rust inhibiting and a natural flux that will facilitate the making of good butt welds. Use BORAX to make better wire at less cost. Used in many mills.

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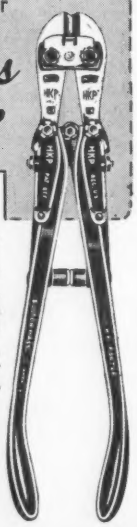

Pressure of 50 pounds on the handles exerts a pressure of 2 TONS at the cutting edge. Tempered spring wire, chrome ball wire, cold-drawn alloy wire, stranded guy wire, cables — wire of all kinds hard or soft, insulated or not, — there's a Porter Cutter that does each cutting job quicker, easier and safer.

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New Bulletin on Oil Standby Equipment for Gas Furnaces

GAS curtailment need no longer cause the disruption of production operations. With the new **Surface Combustion** oil standby equipment, existing Surface gas burners may be readily changed over to operate on fuel oil, during these periods. New 'Surface' furnaces can also be equipped at the time of installation for ready change-over from the standard gas operation to oil operation where necessary. The oil nozzles are sized to provide the same BTU input as the gas burners for these furnaces. This equipment is described in a new 8 page Bulletin, No. SC-139, issued by Surface Combustion Corporation, Toledo 1, Ohio.

* * *

THE bulletin presents, with illustrations, two large installations in which heat treating and bluing furnaces were maintained in operation during critical periods, by the use of this oil standby equipment. Presented also are the controls and additional equipment required as well as the fuel oil specifications for these burners. The oil standby equipment may be applied with a minimum of mechanical manipulation to low and high pressure gas burners as well as radiant tube burners.

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Phosphor Bronze	
Picture Wire	

THE MALIN & CO.
2514 Vestry Ave., Cleveland 13, Ohio

French Improvements in Patenting and Annealing Equipment

by M. Fernand Louis
Bourg, France

THE majority of manufacturers in this country are using what is known as the "through-out" furnace for annealing and patenting wire operations. These furnaces may be heated by coal, oil, gas, or electricity. The choice of furnace heated by electricity depends entirely upon the local conditions.

* * *

THIS type furnace generally consists of the charging section, heating and cooling zones, and the pick-up device or mechanism. A furnace carrying 30 wires requires the removal of the wire from the pick-up, binding of the coils, and supervision of the furnaces. This usually requires the attention of two men. In addition to this, a third man is used on the charging end of the furnace for the purpose of preparing the coils of proper weight on reels and fastening the ends of the coils. It has been attempted to produce extra heavy coils but this has proven to be a disadvantage because of overloading the drawing machine. Heavy coils have therefore been given up.

* * *

INSTEAD of the process as usually followed, we suggest drawing the wire, winding it on reels, in the amount of one ton or more per reel, by a device similar to the pick-up in a setting machine. The preparation of lighter weight coils is not necessary because in this plan the coils are butt welded and no cutting of the wire is required, thus the drawing machine and operation become, in fact, continuous.

* * *

THE coils prepared in the weights mentioned can be handled from the drawing machine in the shortest possible time. The coils are lifted by an electric or hand operated hoist and placed on holders at the back of the furnace. Each holder could be designed for three coils of wire, and as the operation is continuous, one man can supervise and operate all furnaces.

* * *

THIS procedure will cut labor costs by at least one third, and

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Rod Frames — 16" Frames, 8" Frames — Take-Up Frame, Wire — Pointers — Puller Tongs. — General and heat resisting alloy castings for wire mill use.
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Patented all-steel electro-welded Drawing and Annealing and patented metal-bound shipping spools and reels.
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High Speed Upright Cone Machines.
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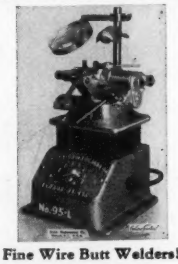

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* * *

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Antitrust Suit Against International Nickel Terminated by Agreement

THE following statement was issued by the **International Nickel Company of Canada, Limited,** in Copper Cliff and Toronto, and in New York, upon the termination of the antitrust proceeding recently in the United States District Court for the Southern District of New York:

"By agreement between the U. S. Department of Justice and the companies the antitrust proceedings against The International Nickel Company of Canada, Limited and its United States subsidiary have been terminated by the entry of a Final Judgment, without trial and without any finding that the companies have violated any law.

"The Consent Judgment disposes of the action started May 16, 1946. The Judgment is confined essentially to two points:

"1. Any special or regular forms of nickel rolling material which International Nickel may be supplying to its own rolling mill at Huntington, W. Va., for the production of non-ferrous high-nickel rolling mill products are to be supplied also to other United States rolling mills which may desire to make these particular products. Prices are to be as favorable as the Company's general prices for nickel sold to the ferrous and other large nickel consuming fields in the United States. The Huntington mill will present to a number of libraries copies of a manual descriptive of

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rolling mill processes employed by it in using special forms of nickel rolling material.

* * *

THE major portion of the Company's nickel sold in the United States is used for alloy steels and other applications and is not affected by the Judgment.

"2. If International Nickel should have occasion to sell nickel rolling material to other foreign producers of such material or of rolling mill products, it will not be a condition of the sale that such producers not import their own production into the United States.

THE Judgment recognizes the position of International Nickel as a Canadian company. It expressly provides that the Company is not required to refrain from doing anything outside the United States which is called for under the laws of Canada or of other countries.

* * *

THE extensive investigation by the U. S. Department of Justice, which started four years ago, has covered the affairs of International Nickel from 1902 until the present. We are gratified that the Department of Justice and the Company have been able by mutual agreement to dispose of this matter by the provisions of the Final Judgment.

G.E. Issues New Booklet On Laminated Plastics

A 15-page illustrated bulletin (No. CDP-578) describing G-E molded and laminated plastics has been issued by the **General Electric Company's Plastics Division.** The bulletin is devoted to a description of the design, moldmaking, and molding facilities of G-E Plastics Division and discusses G-E sealing caps and sleeves, G-E mycalox, G-E silicone rubber, and G-E 1422 high frequency insulation. High and low pressure laminates are summarized along with G-E silent gears, bearings, decorative surfaces, translucent sheets, and name plate materials. Property tables are included for reference.

* * *

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Wire & Textile Machy, Inc., Pawtucket, R. I.

BAKERS—Rod and Wire
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Armco Steel Corp., The, Middletown, Ohio.
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Columbia Steel Co., San Francisco, Calif.
U. S. Steel Export Company, New York, N. Y.

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Wire & Textile Machinery, Inc., Pawtucket, R.I.

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Pacific Coast Borax Corp., New York, N. Y.

BORON CARBIDE—
Norton Co., Worcester, Mass.

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Entwistle, Jas. L. Co., Pawtucket, R. I.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

CABLE LACQUERING OVENS—
Industrial Ovens, Inc., Cleveland, O.

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Mossberg Pressed Steel Corp., Attleboro, Mass.
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CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N.J.

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COMPOUNDS—Diamond
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American Chemical Paint Co., Ambler, Pa.
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Metal & Thermit Corp., New York, N. Y.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Nopco Chemical Co., Harrison N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

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Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison N. J.
Oakite Products, Inc., New York, N. Y.
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Swift & Company, Chicago, Ill.

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Wire & Textile Machinery Inc., Pawtucket, R.I.

CRANES—Wire Mill
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Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

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Vascoloy-Ramet Corp., North Chicago, Ill.
Willey's Carbide Tool Co., Detroit, Mich.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Champion Diamond Co., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

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Champion Diamond Co., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND TOOLS—
Carboloy Co., Inc., Detroit, Mich.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Metal Carbides Corporation, Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Cold Heading
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Eyelet
Hoosier Carbide Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Lead Extrusion
Carboloy Co., Inc., Detroit, Mich.
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Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Metal Carbides Corporation, Youngstown, Ohio.
Robertson, John, Co., Brooklyn, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Pointing
Sjogren Tool and Machine Co., Auburn, Mass.

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Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Eastern Tungsten Carbide Co., Newark, N. J.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

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Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Special Shapes, Etc.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.

DIES—Tubing
Hoosier Carbide Die Co., Ft. Wayne, Ind.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Eastern Carbide Corp., New Rochelle, N. Y.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Hoosier Carbide Die Co., Ft. Wayne, Ind.
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Rusch Wire Die Corp. Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
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Willey's Carbide Tool Co., Detroit, Mich.

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Industrial Ovens, Inc., Cleveland, Ohio.
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Davis, R. L., Elec. Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros., & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Hayes C. I., Providence, R. I.
Morrison Engineering Corp., Cleveland, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Furnace Engineers Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Hayes, C. I., Providence, R. I.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio

FURNACES—Galvanizing Equipment
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Trauwood Engr. Co., The, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Ajax Electric Co., Inc., Philadelphia, Pa.
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Co., Inc., Philadelphia, Pa.

FURNACES—Resistance Healing, Strand
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Salt Bath
Ajax Electric Co., Inc., Philadelphia, Pa.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corporation, Toledo, O.
Trauwood Engineering Co., The, Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING ENGINEER—Consulting
Spowers, W. H., Jr., New York, N. Y.

GALVANIZING EQUIPMENT—
Hanson-Van Winkle-Munning Co., Matawan, N.J.
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

GAVANIZING FLUXES—
Hanson-Van Winkle-Munning Co., Matawan, N.J.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., The, Worcester, Mass.

HAMMERS—Swaging
Sjogren Tool and Machine Co., Aubudn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M. Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
American Insulating Machine Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Du Pont de Nemours, E. I., Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Martin, Glenn L. Company, Baltimore, Md.
Owens Corning Fiberglas Corp., Toledo, O.
Standard Varnish Wks., Staten Island, N. Y.
Twitchell, E. W., Philadelphia, Pa.
Warren Thread Works, Inc., W., New York, N.Y.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

LIME—
Warner Co., Philadelphia and Bellefonte, Pa.

LININGS—Acid and Alkali Proof
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.
Swift & Company, Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Barbed Wire
Reed & Richards Transatlantic Co., Inc., New York, N. Y.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Collers
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (used), New York, N. Y.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Machinery Inc., Pawtucket, R. I.

MACHINERY—Copper Wire Drawing and Rolling
Aetna Standard Eng'g Co., The, Youngstown, O.
American Insulating Mach'y Co., Phila., Pa.
National Machinery Exchange (used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
National Erie Corp., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Porter, H. K. Inc., Everett, Mass.
Reed & Richards Transatlantic Co., Inc., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Aetna Standard Eng'g Co., The, Youngstown, O.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

WHERE TO BUY, Continued

MACHINERY—Extruding
Modern Plastic Machinery Co., Lodi, N. J.
National Erie Corp., Erie, Pa.
Robertson John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R. I

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Wean Equipment Corp., Cleveland, Ohio

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Galvanizing
(See Galvanizing Equipment)

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., The, Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Modern Plastic Machinery Co., Lodi, N. J.
National Erie Corp., Erie, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Looms, Wire Weaving
Bruckner-Mitchell, Inc., New York, N. Y.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Material Handling
Cleveland Tramrail, Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.
Fab-Weld Corporation, Philadelphia, Pa.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Black Industries, Cleveland, Ohio
Glader, Wm., Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Reed & Richards Transatlantic Co., Inc., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Plating Electrolytic
Hanson-Van Winkle-Munning Co., Matawan, N.J.

MACHINERY—Pointing
Aetna Standard Eng'g Co., The, Youngstown, O.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rubber Insulating
Royle, John & Sons, Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R. I.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Black Industries, Cleveland, Ohio
Bruckner-Mitchell, Inc., New York, N. Y.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
National Erie Corporation, Erie, Pa.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Boyd, Charles P. Corp., Philadelphia, Pa.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
National Mach'y Exch. (Used), New York, N.Y.
Modern Plastic Machinery Co., Lodi, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Reed & Richards Transatlantic Co., Inc., New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINFRY—Steel Bale Ties
Reed & Richards Transatlantic Co., Inc., New York, N. Y.

MACHINERY—Straightening
Lewis Machine Co., The, Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Reed & Richards Transatlantic Co., Inc., New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
Hughesville Machine & Tool Co., Hughesville, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Ruesch, H. J., Machine Co., Newark, N. J.
Steel Equipment Co., Cleveland, Ohio.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
National Erie Corp., Erie, Pa.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Testing Physical
American Optical Co., Buffalo, N. Y.
Scott Testers, Inc., Providence, R. I.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L. Elec. Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.
Wire & Textile Machinery, Inc., Pawtucket, R.I.

MACHINERY—Tinning Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Steel Equipment Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila, Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
National Erie Corp., Erie, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila, Pa.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Aetna Standard Eng'g Co., The, Youngstown, O.
Industrial Ovens, Inc., Cleveland, Ohio.
Modern Plastic Machinery Co., Lodi, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
Aetna Standard Eng'g Co., The, Youngstown, O.
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Steel Equipment Co., Cleveland, Ohio
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machine Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Forming
Eisler Engineering Co., Newark, N. J.
National Mach'y Exch. (Used), New York, N.Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Reed & Richards, Transatlantic, Inc., New York,
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N.Y.

MACHINERY—Wrapping Wire Coils
Angier Corporation, Framingham, Mass.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail, Div. of The Cleveland Crane & Engineering Co., Wickliffe, O.
Fab-Weld Corporation, Philadelphia, Pa.

MATERIAL—Resistance Heating Strand
Trauwood Engineering Co., Cleveland, Ohio.

NAILS—Wire
American Steel & Wire Co., Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling, John A. Sons Co., Trenton, N. J.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
U. S. Steel Export Co., New York, N. Y.

NAIL DIE GRINDERS
Reed & Richards Transatlantic Co., Inc., New York, N. Y.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Chase Brass & Copper Co., Waterbury, Conn.
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.

WHERE TO BUY, Continued

OPTICAL EQUIPMENT—Metallurgical
American Optical Co., Buffalo, N. Y.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Angier Corp., The, Framingham, Mass.
Crepe-Kraft Company, The, Division
National Waterproof Papers, Inc., Newark, N. J.

PAPER—For Coil Wrapping and Corrosion Prevention
Angier Corp., The, Framingham, Mass.
Crepe-Kraft Company, The, Division
National Waterproof Papers, Inc., Newark, N. J.

PAPER TESTERS—
Scott Testers, Inc., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING—Hooks, etc. Acid Resisting
Gordon, Clark E., Detroit, Mich.

PICKLING TANK LININGS—
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I

PLATING PROCESS—Electrolytic
Hanson-Van Winkle-Munning Co., Matawan, N.J.

PNEUMATIC CYLINDERS
Entwistle, James L. Co., Pawtucket, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio

POTS—Lead Melting
National Annealing Box Co., Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS AND GRIPS—For Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdy & Mach. Co., Trenton, N.J.
Sjogren Tool and Machine Co., Auburn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STANDS—
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg., Co., The, Hazardville, Conn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., Hazardville, Conn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wire Mill
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.
Howsam Spool Co., Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

REELS—Wooden
Bridge Mfg. Co., Inc., The, Hazardville, Conn.
Durkee Mfg. Co., Pine River, Minn.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

RESISTANCE HEATING—Annealing, Patenting, Etc.
Trauwood Engr. Co., Cleveland, Ohio.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N.Y.

RODS—Nickel Alloy
Eastwood Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N.Y.

RODS—Stainless Steel
Armco Steel Corp., The Middletown, Ohio

RODS—Wire—Non-Ferrous
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROPE—Wire
American Steel & Wire Company, Cleveland, Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Roebling's, John A., Sons Co., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel, Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
(See Compounds—Rust Preventing)

RUST REMOVING COMPOUNDS—
(See Compounds—Rust Preventing)

SATURATION SYSTEMS—
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy, Inc. Pawtucket, R. I.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Armco Steel Corp., The Middletown, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Nopco Chemical Co., Harrison N. J.
Potter, Neil C., Newark, N. J.
Swift & Company, Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Clark Mfg. Co., J. L., Rockford, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp.,

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Clark Mfg. Co., J. L., Rockford, Ill.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Chase Brass & Copper, The Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Armco Steel Corp., The Middletown, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

TANK—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Haveg Corp., Newark, Del.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Penna.

TINSEL—Cords, Decorative
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Electric Conductor
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Electric Resistance
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Lame, Silver and False Gold
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Thread, Silver and False Gold
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TINSEL—Thread, Decorative
Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.
North American Philips Co., Inc., New York, N.Y.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Niles Steel Products Div., Republic Steel Corp., Niles, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy, Inc. Pawtucket. R. I.

TUBE BENDERS AND FORMERS—
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ruesch, H. J. Machine Co., Newark, N. J.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
General Electric Co., Schenectady, N. Y.
Standard Varnish Wks., Staten Island, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Sciaky Bros., Inc., Chicago, Ill.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y. Co., Phila., Pa.
Davis, R. L. Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.
Wire & Textile Machy, Inc. Pawtucket, R. I.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
Armco Steel Corp., The Middletown, Ohio
American Steel & Wire Co., Cleveland-Chicago, New York.
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper, The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
North American Philips Co., Inc., New York, N.Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Armco Steel Corp., The Middletown, Ohio
American Steel & Wire Co., Cleveland-Chicago & New York.
Bethlehem Steel Co., Bethlehem, Pa.
Chase Brass & Copper, The, Waterbury, Conn.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., of Colorado Fuel & Iron Corp., Buffalo, N.Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Nickel & Nickel Alloy
Eastwood-Nealley Corp., Belleville, N. J.
International Nickel Co., Inc., New York, N. Y.

WIRE—Music
American Brass Co., The, Waterbury, Conn.
American Steel & Wire Co., Cleveland, Chicago-New York.
Columbia Steel Co., San Francisco, Calif.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.
Paramount Wire Co., New York, N. Y.
U. S. Steel Export Co., New York, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WIRE—Nickel Silver and Phosphor Bronze
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper, The, Waterbury, Conn.
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper, The, Waterbury, Conn.
Eastwood-Nealley Corp., Belleville, N. J.
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., New York, N.Y.
Paramount Wire Co., New York, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRESERVING—Paper and Cotton
Paramount Wire Co., New York, N. Y.

WIRE—Spring
American Brass Co., The, Waterbury, Conn.
Armco Steel Corp., The Middletown, Ohio
American Steel & Wire Co., Cleveland - Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Columbia Steel Co., San Francisco, Calif.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
U. S. Steel Export Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
Armco Steel Corp., The Middletown, Ohio
American Steel & Wire Co., Cleveland-Chicago-New York.
Columbia Steel Co., San Francisco, Calif.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
U. S. Steel Export Co., New York, N. Y.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth Sterling Steel & Carbide Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Paramount Wire Co., New York, N. Y.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Straightening and Cutting—
Paramount Wire Co., Inc., New York, N. Y.
Pittsburgh Cut Wire Co., Pittsburgh, Pa.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.
Wickwire Brothers, Cortland, N. Y.
Wickwire-Spencer Steel Division of Colorado Fuel & Iron Corp., Buffalo, N. Y.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
American Brass Co., The, Waterbury, Conn.
Chase Brass & Copper Co., The, Waterbury, Conn.
Hudson Wire Co., Ossining, N. Y.
Paramount Wire Co., New York, N. Y.

WRAPPING PAPER—Creped
Angier Corporation, Framingham, Mass.
Crepe-Kraft Company, The, Division National Waterproof Papers, Inc., Newark, N. J.

YARNS & TAPES—
Du Pont de Nemours, E. I., Co., Wilmington, Del.
General Electric Co., Schenectady, N. Y.
Owens Corning Fiberglas Corp., Toledo, Ohio.
Twitchell, E. W., Philadelphia, Pa.
Warren Thread Works, Inc., W., New York, N.Y.

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

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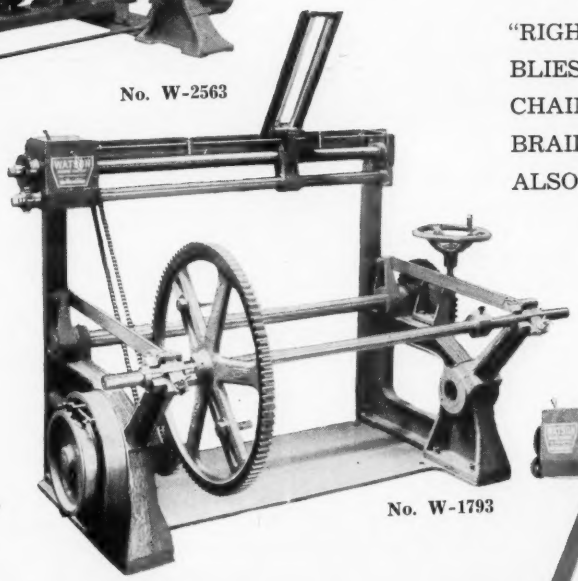

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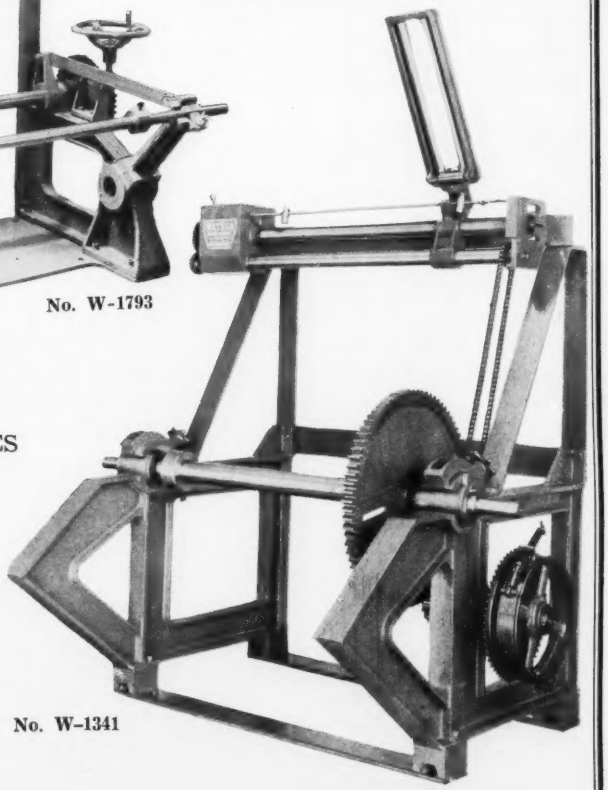

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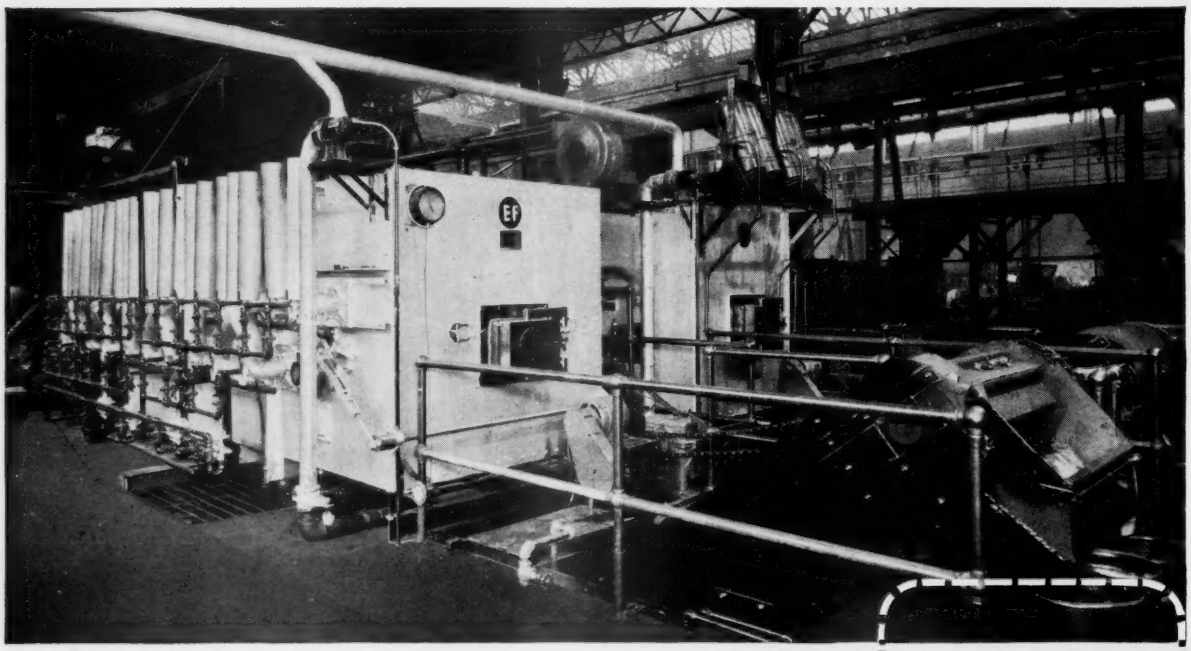

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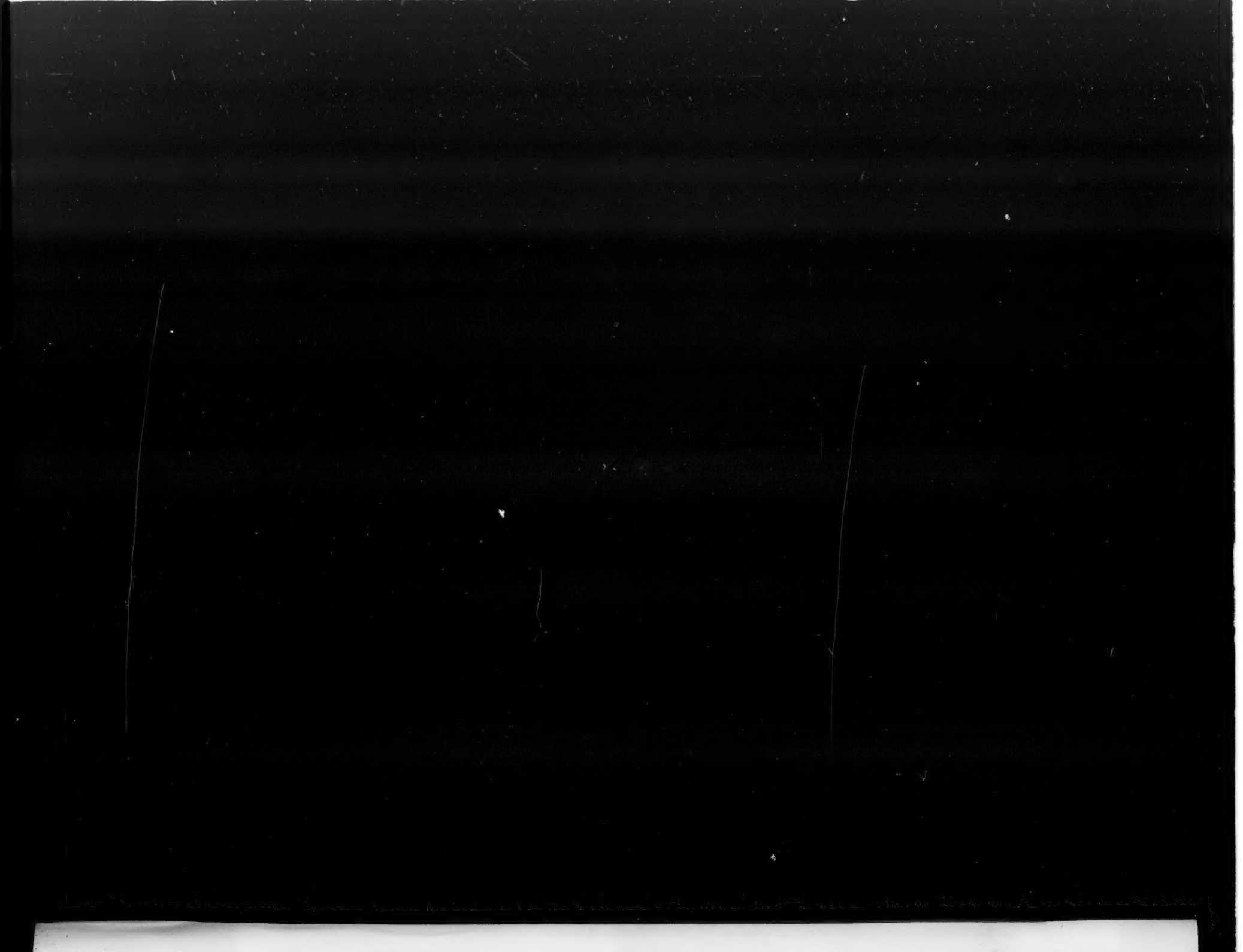
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